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ABSTRACT

This report reviews major theoretical and empirical studies concerning the process of creativity and the skills involved in creating art. Part I describes process studies with adult subjects engaged in activities such as poetry writing, editing, and critiquing a poem. Ten amateur and ten professional poets were subjects. These studies analyzed the poets' thought process; writing process; characteristics of critical appraisal; and personal backgrounds, attitudes, and practices. Competence, sources of critical disagreement, difficulties in critical judgment, and errors in reasoning are also examined. Part II, Studies of Central Components in the Arts, comprises four sections which examine the way in which major symbol-using capacities develop in children aged 12 months to 19 years. The first, most extensive, section reviews studies on the development of skills deemed central to the arts, such as metaphoric competency, style sensitivity, and the emergence of critical skills. The second section reports studies of breakdowns of symbolic competence under certain conditions of brain damage. The third section focuses on the full range of symbolic systems rather than just those in the arts, and is concerned with the nature of symbolic media such as television. The last section, which is directed at the educational community, presents conclusions from a number of more general inquiries on aesthetic development and education. (KC)

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ANALYSIS AND TRAINING OF PROCESSES AND COMPONENT SKILLS IN THE ARTS

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PROJECT ZERO
Harvard University
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David Perkins and Howard Gardner

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Introduction and Overview

Core support provided by the National Institute of Education to Harvard Project Zero over the past four and a half years has permitted a wide range of research projects in the area of the arts and cognition. In this final report we review our major theoretical and empirical findings, as well as a spectrum of other activities undertaken by the Project.

Our goal for this document has been to introduce the reader to the full range of the Project's effort. We have minimized technical details, which usually can be found in published or soon-to-be-published papers, and avoided the sort of broad synthesis better accomplished through a less descriptive review. Rather, we have aimed at a comprehensive record of the past several years. Readers are encouraged to consult those sections of the report which deal with their areas of interest and to gain further information about the work either from the papers mentioned therein or by contacting us.

For the most part, the plan of the report follows that of earlier communications to the National Institute of Education: There are two major sections, one dealing with process studies and focusing on adult subjects, the second dealing with central components in the arts, and focusing on children. Some additional sections have been included to give accounts of work which does not readily fit under this rubric.

I. Process Studies

One part of this project has taken what might be called a "process study" approach to artistic endeavor. The investigations have dealt mostly with large-scale activities like writing or editing a poem or critiqueing a painting, rather than with constituent performances in isolation. The aim has been to work 'from the top down' rather than 'from the bottom up', trying to understand molar activities in their complexities and contributing skills in context. In contrast, the studies of part II principally work 'from the bottom up', investigating important component skills in detail. The present studies also deal entirely with adults and often with expert practitioners, though this is incidental to a process study approach.

No grand hypothesis has guided the research reported here. Rather, a number of general questions have channelled the inquiry. For instance, what qualitative account can be given of the character of creative and critical activity? How do the popular stereotypes of creative and critical activity hold up when such behavior is examined closely? What do better practitioners do to achieve better results? What sorts of lapses occur? What opportunities for educational intervention appear?

The first section below deals with some general matters of methodology. Section B concerns the process of producing art. Mostly it relates an extensive study of ten amateur and ten professional poets, a study examining their writing process by several different methods. However, other investigations on poetry editing, solving insight problems, and mathematical thinking supplement the material on the poets.

Section C concerns critical response to art. Some of the data derives from the poet-subjects mentioned above. Further material includes some experiments on critical judgment and on reasoning and three general, interpretive studies.

Section D provides a brief description of several articles, a book and a course related to the general themes of this report.

A. Matters of Methodology

1. Gathering reports of thinking

Much of the work to be described relied upon subjects' reports of their thoughts while working on a task. A significant part of the investigation consisted in devising and refining effective procedures for soliciting such reports in so sensitive an area as the arts.

"Thinking aloud" was one method used: Subjects were asked to think aloud as they attempted the task being investigated. They first practiced thinking aloud on a puzzle not related to the experimental task. It was found that several characteristic difficulties with thinking aloud usually could be resolved by instructing subjects appropriately and occasionally prompting them. 1) Subjects were to express whatever was on their minds, not to hold back hunches, false starts, etc., and report only conclusions.

2) Subjects were encouraged to speak as continuously as possible, saying something at least once every five seconds, even if only "I'm drawing a blank." Without this instruction, subjects would sometimes lapse into silences of up to 30 seconds, often during the most interesting episodes. With this instruction and initial prompting, subjects quickly learned to report continuously with little need for further prompting. 3) Experience revealed a tendency for subjects' voices to drop as they became involved in the task. Therefore, subjects were asked to maintain a moderate volume. 4) Subjects were encouraged to speak as telegraphically as they pleased, and to not worry about complete sentences or eloquence. 5) A tendency to overexplain or justify proved to be the single most troublesome problem in thinking aloud. Subjects were urged not to analyze their thoughts for the experimenter, but simply to say what they were thinking. 6) Subjects were not to fall into a pattern of thinking for a while and then describing their thoughts. Rather they were to say what they were thinking at the moment.

In general, for most subjects thinking aloud proved an easy technique to master. Experience showed there to be a strong "warm-up" effect; sometimes starting off awkwardly, a subject quickly would become accustomed to the procedure and absorbed in the task. Within five minutes or a little more, the thinking aloud would proceed fairly fluently.

A second technique was "retrospection". This method recognized that thinking aloud did not give a subject time to report all that had happened, particularly at crucial moments of insight where relatively rapid chains of thought often occur. Retrospection asked subjects to recall in as much detail as possible the last several seconds of thought leading up to a particular event -- the completion of a poetic phrase or the solution to an insight problem, for example. Subjects were urged not to speculate about explanations, but to report only what they remembered.

2. <u>The validity of reports of thinking</u>

Such investigative techniques as thinking aloud and retrospection naturally must be questioned: Might not the techniques disrupt the very activities they sought to probe? Certainly methods of this sort <u>could</u> be disruptive. But as related above, care was taken to define the techniques so that they would not divert the subject from his train of thought and to train subjects briefly. These efforts seem to have payed off: So far as could be told, interference was minimal. Subjects were asked how they felt their work went and how they thought the thinking aloud and retrospecting had affected it. Often, subjects would report that the thinking aloud slowed them somewhat. Only a couple of subjects indicated that they felt it to be substantially disruptive, and then on only one of their two sessions of thinking aloud. Also, a couple of subjects reported unusually effective sessions while thinking aloud. In addition, the protocols of subjects' reports did not indicate a seriously disrupted thought-process, but rather a reasonably orderly one which addressed the task and made progress. Naturally, there is no way of demonstrating that subjects were thinking in exactly the same way they would have had they not been reporting their thoughts, and furthermore it would be somewhat surprising if every turn of thought were just the same. But broadly speaking, there was no reason to believe that subjects' thought-processes were dramatically disrupted.

The question remains whether subjects would report their thought processes correctly.

The issue is of particular moment since recent findings in other areas argue that subjects often give rather poor accounts of their grounds for opinions and judgments. Again, no absolute answer is possible in the present case, since there could not readily be any objective data against which to compare subjects' reports of their own thought processes. However, the circumstantial evidence is encouraging. First of all, the sorts of problem-solving activities studied are among those considered least likely to produce the reporting problems identified elsewhere. Secondly, it is important to note that the protocols gathered make sense, but not too much sense. That is, on the one hand they describe reasonably coherent sequences of thought that do indeed seem to disclose how a subject might have achieved what he did. On the other hand, they are not totally coherent and organized. That is, if subjects tend to "fill in", they do not do so nearly as much as they could.

Such indications are the best the circumstances allow. In the long run, the findings resulting from reported thoughts perhaps can be subjected to tests of other kinds and stand or fall in more objective arenas. Meanwhile, reports of thinking remain a rich source of seeming information, information obtainable in no other way.

3. Content analysis

The questions asked of the data gathered in these studies often required the use of content analysis. That is, a judge had to classify into a predefined set of categories various events occuring in a protocol, a critique of a work of art, an argument, or some other sort of linguistic data.

Care was exercised to ensure reliability in content analysis. Two judges would classify a sample of the data. If adequate agreement was not achieved, the category definitions would be refined. Often, the categories would require reworking several times before final scoring. Usually, final scoring involved both judges categorizing all the data, comparing results and settling any disagreements by discussion. Occasionally, one judge would score all the data, and another would score a subsample to test for adequate reliability. The exact thresholds of reliability which were deemed adequate varied with the number of categories and other factors. Roughly speaking, an 85% agreement was considered satisfactory for one judge to score all the data, and a 70% agreement considered marginally satisfactory if two judges scored all the data and settled disagreements. However, two judges usually scored all the data even when agreement was well above 85%.

B. Studies of Production

1. Poetry editing

(A better word: Studies of poetry editing. D. N. Perkins, in The Arts and Cognition, D. N. Perkins and Barbara Leondar (Eds.), Baltimore: Johns Hopkins University Press, 1977.)

This study commenced before the period of the present grant; the analysis was completed and the experiment reported during the grant.

The study examined the process of poetry editing. Five brief poems or excerpts were selected, poems which seemed to have somewhat awkward final lines. Sixteen subjects were each asked to improve the underlined words in the last lines of the five poems. The subjects were students at Harvard University. Half were amateur poets and half not. The subjects were to think aloud as they worked.

On the whole, the subjects did not succeed very well. Awkward, meaningless, metrically jarring substitutions, or substitutions with other flaws, were commonplace. In 71% of the cases, subjects proposed a substitution they felt might better the original (subjects were allowed to conclude they could not improve upon the original) and of those, only 24% were judged to be on par with or better than the original.

The analysis of subjects' protocols sought to determine the reasons for poor performance. The analysis viewed subjects' efforts as a search process. It was concluded that subjects did poorly because they failed to search through sufficiently many options, failed to search adequately for possible flaws in candidate substitutions, searched in unfruitful directions, and in general did not manifest an effective search process at several levels.

It remained to be seen whether subjects' searching was inept because they could do no better. Six of the original subjects were re-tested on various fluency tasks, some derived from their own individual protocols. Also, they were given another poem to improve while following a prescribed procedure stressing deferred closure and comparative assessment of alternatives. Subjects revealed an ability to generate considerably more alternatives and to evaluate them more sensitively than indicated by the original protocols. It was concluded that subjects' original difficulties stemmed not so much from lacking the capacities needed as from failing to deploy them in an effective, well-organized way.

2. A study of poetry writing -- methods and measures

The method

This study aimed to investigate the complex thought processes involved in artistic creation. The study focussed on the writing of poetry. A number of issues were probed during the study and data gathered in several different ways. The present paragraphs outline the method. Following sections describe the particular issues examined and the outcomes.

The final subjects were 10 amateur and 10 professional poets. In addition, there were several amateur and professional pilot subjects. Amateur subjects had to have written several poems in the last year as indication of serious involvement, but could have had no publications in nationally distributed journals. Publications in school literary magazines were allowable. Professional subjects were required to have a least one book publication. Amateur subjects were contacted by notices around Harvard University. Professional subjects were contacted principally through suggestions from prior

professional subjects. The professional subjects received a small honorarium and the amateur subjects a conventional subject fee.

Data of several sorts was obtained. First of all, an experimenter interviewed each subject for an hour or sometimes considerably more, working from a written list of questions which examined varied aspects of the subjects' involvement in poetry: the history of the subject's interest, the poets the subject admired, the subject's usual writing practices, and so on. Second, each subject undertook a simple fluency test which asked him to produce as many words or phrases as he could meeting various conditions. Third, each subject was asked to critique a poem given to him as he would for a peer or student. Fourth, each subject returned to edit a poem he had begun already, while thinking aloud and occasionally (not more than three times per session) being interrupted for a retrospection. Fifth, each subject returned to begin a new poem, perhaps with an idea already in mind, under the same conditions. It must be said that though the latter demand sounds severe, the subjects, used to the experimenter, impressed by the care of the interview, and trained briefly in the thinking aloud procedure, generally responded well. The two writing sessions took about an hour and a quarter each.

In addition to the poet subjects, four professional and three amateur artists were run on the "think aloud" part of the experiment. Their developing work was videotaped and further documented by 35 millimeter slides taken periodically throughout the sessions. These subjects were to provide a comparison check for conclusions reached on the poet subjects. However, only a couple of the analyses have been checked against the artist group. No differences have appeared.

Measures of subjects' competence

There was a need for measures of the subjects' competence as poets to relate to their behavior in the experiment. One possible measure was provided by the professional - amateur grouping. A second measure was constructed by assessing subjects' prior works.

Each subject provided a sample of representative poems. Two of these were selected arbitrarily for each subject, and grouped with the poem-in-draft he had used during his editing session. Three of the professional poets in the sample were paid to be judges. Each independently examined 57 poems, three from each of the other 19 subjects, in random order with author not identified. Each judge tape-recorded a nearly line-by-line commentary on each poem, as well as an overall assessment. The former was requested to assure that the judges paid full attention to the poems. Listening to the tapes, an experimenter scored the judges' comments, positive or negative, on a 7 point scale. A score was derived for each judge for each poem by averaging the scale values of comments on individual lines. A score from each judge for each poet was derived by averaging the scores for the three poems associated with that poet.

If this procedure achieved anything like objectivity, one would expect high correlations among the scores of the three judges. This was not the case. Taking the judges in pairs, the three correlations were .5, .6, and .1, the first two reaching statistical significance.

Nevertheless, information from other sources encouraged proceeding cautiously with a competence measure derived from the judges. Prior studies have shown that artists are likely to disagree among themselves more than artist-teachers, but that in both cases when individual disagreements are averaged out a strong evaluative trend appears, rather than all ratings coming out to about the same in the mean. Therefore, in hopes that the same would happen here, the scores from each judge were normalized and averaged to assign an overall quality score to each subject. Also, the top and bottom ten subjects on the quality scale were determined, to provide a dichotomous variable like professionalism.

Quality was found not to be significantly correlated with professionalism although the trend lay in that direction. Six of the professionals fell in the high quality group, but four in the low. This result also might be taken to challenge the validity of the quality variable. On the other hand, professionalism may not be as reflective of true competence as once would like to think.

In the analysis of the data, professionalism and quality both were used as possible measures of competence. As will be seen, some significant findings related to one, some to the other, and some to both.

3. The emergence and selection of poetic material.

In any study of poetry writing, the history of the word or phrase is a natural focus of interest -- when was it first conceived, what led to its conception and what was its consequent course of approval, rejection or revision? A thorough answer to such questions would reveal much of the nature of poetic creation. The following three studies barely begin that enterprise by describing some broad characteristics.

Study 1: Directed versus spontaneous production

One account of poetic creation has the poem in effect "received" by the poet. The poet simply writes what comes to him, and sometimes good poems come. There is enough autobiographical testimony of such experiences to suggest that this sometimes happens. But what typically happens? An anwer was sought in the protocols of subjects' thoughts.

This analysis focussed on moments of production, where a subject had conceived and written down a phrase, accepting it at least tentatively. The analysis considered only productions for which a retrospective had been gathered, since the retrospective provided a more detailed account of the thoughts leading up to the production. The analysis asked whether the poet had any precondition in mind which would seem to have guided the poet to produce the phrase. A precondition was a constraint which the poet had mentioned in thinking aloud shortly before the production, or in the retrospective as occuring before the production. For instance, a poet might say, "I need a word to rhyme with 'belt'," or "I want to get at the texture of the rain." Only preconditions which the production appeared actually to satisfy were counted.

It was found that preconditions were commonplace. Over the 20 subjects, 51 productions were examined, and of these most exhibited one or more preconditions. The preconditions varied greatly in their specificity: many would only loosely constrain the consequent production, whereas others would specify it closely enough so that one plausibly might list options on the basis of the precondition alone, other contextual factors aside.

It is important that the limits of this result be recognized. It does not imply that phrases are never "received". On the contrary, in many cases there was no announced precondition, and although subjects cannot be expected to have reported everything they thought, in many of these no doubt there was no conscious precondition. Even when a precondition is mentioned, this does not imply that the production is wholly explained by an effort solely to meet the precondition. It will be remembered that many preconditions only loosely constrained the productions. One has to account for the fit of production to poem-so-far in terms of an unstated and partly unconscious grasp of the situational demands.

But these caveats notwithstanding, the present results show that a poet's productions, far from emerging "out of the blue", usually follow in consequence of a partly conscious condition.

Study 2: Use of a trial-and-error strategy

How does a poet achieve the kind of quality he wants in a poem? One extreme possibility is that the poet simply conceives from the first the poem as he desires it. However, the considerable editing evident in the protocols, reported in the interviews, and apparent from other sources belies this. Another possibility is that a poet might search through multiple alternatives and select one for a particular word or phrase in his poem. This could be called a trial-and-error strategy. Such a strategy would fit well with evidence from this and other studies that fluency in producing alternatives is linked to effectiveness: easier production of options would lead to a wider choice and better results.

The retrospectives were used to investigate whether a trial-and-error strategy appeared. For phrases on which retrospectives were available, the retrospectives as well as the thinking aloud protocols were inspected to determine whether alternative phrases for the same slot in the poem had been considered. The alternative phrases were listed and counted.

In general, there were few alternatives -- none in a little more than a third of the cases, one in about another third. In only 4 out of 51 cases did a subject consider four or more alternatives. These results argued that a poet's mainstay was not a vigorous trial-and-error strategy wherein many options were considered. Instead, the poet would produce within one or two tries a phrase which at least for the moment met the need as he perceived it.

It should be noted that this finding still would allow a trial-and-error strategy with many trials to figure over longer periods. Conceivably, a poet might return to the same phrase again on successive reworkings

of a poem, modifying it many times until he was satisfied. There was no way to assess this on the basis of the data gathered.

Difficulties subjects experienced in the poetry editing study described earlier (Section 1) were traced in large part to inadequate exploration of alternatives. Certainly circumstances encouraging such exploration arise in the normal course of poetry writing: there were a couple of retrospectives where subjects considered five or six alternatives. But this was rarely so. The present findings suggest that the poetry editing study examined a rather special situation when constraints were high, adequate phrases came hard, and so consideration of multiple options carried particular power.

Study 3: Mechanisms of metaphor

Episodes in the protocols gathered from poets contributed to the formulation of some theories about metaphor production. In particular, three mechanisms for metaphor-making were posited. The first, called metaphorical perception' or more generally 'contrary recognition' refers to cases where a person recognizes the likeness of one thing in another, as a house resembling a face. The second occurs when a person abstracts a property of the metaphorical subject and uses it to generate the metaphorical predicate. For instance, a person might begin with an orange, note that oranges are bright and happy, ask himself what else is bright and happy, come up with circus, and construct a simile something like "The orange was bright as a circus." The third constructs a metaphor by classifying one thing as a kind of something else. For instance, a banana, as a kind of dog, might be a dachshund.

Evidence at least suggestive of these three mechanisms was found in the protocols. In addition, one could deliberately exercise each mechanism to generate metaphors, thus demonstrating the possibility of each. There was insufficient data to examine which mechanism was most common or what other mechanisms might also operate. It was at least clear, however, that the three could not be considered independent: they might collaborate to some extent to yield a metaphor. Research on this theme is continuing.

The notion of contrary recognition is discussed and illustrated with extracts from the poets' protocols in the article Metaphorical perception, D. N. Perkins, in E. Eisner (Ed.), Reading, the arts and the creation of meaning. National Art Education Association, 1978.

4. The emergence and nature of critical appraisals.

What a poet seeks to do often is guided by his critical appraisal of needs or difficulties in earlier drafts. Indeed, the considerable time poets characteristically spend on their poems (see section 6, theme 5) suggests that much of the quality of the poem is won through cycles of criticism and correction. The following studies explore the circumstances and characteristics of critical appraisals.

Study 1: Directed versus spontaneous evaluations

Evaluations constituted another important element of subjects' reports. These ranged from vague exclamations like "good!" to evaluations with reasons carefully spelled out (see studies 2-4 below).

A question parallel to that earlier asked of productions arose: Were evaluations received or directed. That is, did the poet simply spontaneously react to what he had written, or did he look for particular kinds of success or failure, deliberately appraising the meter, the thematic unity, or whatever.

A sample of evaluative reactions from each protocol was examined. The artist protocols were used as well. There were hardly any occasions where an explicity evaluative aim was announced. Since subjects could not be expected to report all their thoughts, probably there was more consciously directed evaluating than appeared in this result. Still, the trend was apparent: The poets usually scrutinzed in an undirected way, alert to pick up whatever difficulties there may be. They noticed particular kinds of problems rather than seeking them out (see section 7, study 2 on noticing).

This conclusion contrasts with conventional wisdom on evaluation and production. Production is supposed to be the spontaneous process, and evaluation the more focussed analytical one. The present results suggest exactly the opposite.

Study 2: Reasons in evaluations

A further examination of subjects' evaluative remarks assessed whether the remarks were accompanied by reasons. Again, this related to a classic issue: some would propose that a poet or artist is guided by a sense of rightness or wrongness with little conscious conception of the details. In the present analysis, having a reason was taken to mean giving information in the evaluation about just what was wrong, or right, about the poem. That information might take three forms: localization -- the evaluation attributed an asset or difficulty to particular words or phrases, rather than to the poem broadly; aspect -- the evaluation explicitly concerned some dimension of a section of text, such as meter, rhyme, meaning, rather than the section of text as a whole; and principle -- the evaluation mentioned what amounted to a critical principle such as unity, variety, originality in characterizing the asset or difficulty.

The analysis drew upon four sources of data: the poetry writing study, the work with the artists, the poetry editing study described earlier, and a thinking aloud study of students asked to design logos. Random samples of evaluations were selected from each protocol of each group and scored for the presence of the features described.

The scoring showed that nearly always evaluations involved considerable localization. Furthermore, from about half to 80% of the time, depending on the group, an evaluation would have either an aspect or a principle. Aspects occurred from about 30 to 80% of the time, principles from about 40 to 60. Thus there was some difference among the groups, but aspects and principles proved plentiful in all cases.

Again keeping in mind that subjects do not say as much as they are aware of, these results add to the evidence accumulating here that subjects are much more conscious of what they are about than often is thought. In particular, evaluation often is attributed to a poet's intuitive powers. Analyzed rightly, however, intuitive judgments are judgments without reasons, and so the present findings argue against predominantly intuitive judgments. This data and the issue of intuition are discussed further in "The limits of intuition," D. N. Perkins, Leonardo, 1977, 10, 119-125.

Study 3: Poets' use of critical principles

An effort was made to examine the critical principles poets relied upon. One aim was to profile which principles poets exercised. This would provide a better overall characterization of the poetic enterprise. The second aim was to seek differences between the different groups. For example, the professional versus amateur poets or the poets of high versus low judged quality might differ in their patterns of attention to principles.

A taxonomy of critical principles was developed. The taxonomy included thirteen categories with such general names as unity, clarity, truth, originality. These were broad labels under which were tallied various sorts of events. For instance, unity was used to tally any mention that a part of a poem was well-organized, consistent, coherent, or opposites of these such as disorganized, fragmentary, mismatched. All the poetry transcripts were scored for all mentions which could be classified into one of the principles.

There resulted a clear characterization of the poets' concerns. The category most often represented was unity, comprising 29% of all mentions of principles. Next was originality, accounting for 15%. Covering 11% of the cases was a category including mentions of something being excessive, unnecessary, extraneous or the opposite. Concern for clarity accounted for 10% of the cases, for truth or realism, 8%. Other principles occurred less frequently. All in all, these figures reflect the poets' abiding concern with unity in the broad sense, including coherence not only of the whole poem but individual lines, and with originality.

Group differences were not found. Professionals were compared with amateur poets, high with low quality groups, and creation sessions with revision sessions. In all cases, the profiles of attention to the different categories remained nearly the same.

The closest to a group difference occurred in the originality category. The percentage for amateur versus professional attention to this category was 12 versus 18%, and for low quality and high quality subjects, 11% versus 18%. It is tempting to conclude that the more competent poets gave more attention to originality, especially since this would make considerable sense. However, the differences were but marginally statistically significant, between .05 and .1. Furthermore, it must be remembered that a number of other comparisons were made, so that a spurious difference verging on statistical significance would not be at all unlikely. At most, the contrast in originality figures can be taken as an intriguing hint.

Study 4: Poets' attention to aspects of poems

An effort was made to ascertain what aspects of their poems-in-progress subjects attended to. Again the aims were to develop a profile of attention and to test for any differences associated with competence.

A taxonomy of thirteen aspects was developed. This included such categories as rhyme, soundplay, rhythm, content, interpretation, form. Any remark which indicated attention to one of these aspects was categorized accordingly. All the poetry transcripts were scored for any such remarks.

A profile of poets' pattern of attention was indeed obtained. By far the most frequent category was 'content'. Basically, content concerned the superficial level of meaning. Content was scored when a poet referred to characters, objects, plot or other such elements explicitly present in the poem. The finding points to the unsurprising conclusion that most of the time, poets are concerned with shaping their poems to have some sort of surface semantic adequacy. Interpretation was the next most frequent category, but it accounted for only about 9% of the remarks scored. Mood accounted for 6%, reflecting concern with the emotional or expressive content of the poem. No other category exceeded 5%.

A comparison of professionals with amateurs revealed a marked difference. Where about 70% of amateurs' scored remarks concerned content, only 53% of professionals' remarks did so. Statistically, this result proved to be highly significant ($p \ll .001$). Correspondingly, the professionals distributed their attention more over other aspects. For example, professionals exhibited more frequent concern with form, the visual layout of poems, and meter, all differences individually significant ($p < .02$).

Recalling that the professional-amateur distinction might be taken as a measure of competency, one is tempted to conclude that the more distributed attention of the professionals reflects their greater ability to juggle the multiple factors relevant to a work of art. Unfortunately, the quality measure of competence did not corroborate this. There was virtually no difference in percentage of content remarks between the low and high quality groups. Other scattered contrasts proved significant -- for example, the better poets paid less attention to visual layout, more to form. But a consistent pattern failed to emerge.

5. Fluency and facility in writing

As used here, fluency refers to performance on several tasks the subjects in the study of poets were asked to undertake, and facility refers to subjects' actual efficiency in completing poems to their own satisfaction, according to their reports. Fluency of the sort tested has been considered by some to be a measure of creative abilities independent of intelligence. Unusual facility is a notable characteristic of some major figures in the arts, for instance Shakespeare or Mozart, although other figures such as Beethoven are known to have worked much more deliberately. Often, special facility is imagined to be one sign of an especially gifted artist. With these matters in mind, how quality of products relates to fluency and facility becomes of interest.

Study 1: Measures of fluency and their correlation with competence

It has often been hypothesized that creative abilities are related to fluency -- the capacity to produce multiple and original items satisfying given conditions. Some empirical evidence exists for this contention. The study of poets sought to investigate the hypothesis further. To this end, each poetry subject attempted nine fluency tasks. The first three requested the subject to name as many items as he could exemplifying given properties, for instance "spherical and white." The second three asked the subject to list properties describing a given object, for instance an apple. The last group of three invited subjects to name broader categories an object would fall into. For instance, a car might be a vehicle, a means of transportation, etc. The the three kinds of tasks were chosen as ones which might arise naturally in the process of constructing poetic expressions. In all cases, a subject was to continue until he could think of no further items at all readily.

Each question yielded two fluency measures for each subject. One was simply the number of items the subject produced -- his "productivity". The second appraised the uniqueness of those items by weighing each item a subject had mentioned according to its frequency: an item all other subjects had mentioned would contribute nothing, an item none other had mentioned a great deal. Normalized and averaged for each of the three groups of tasks, the productivity measures showed that the kinds of tasks were related. Correlations among the three clustered around .5, significant at a .05 level. The two measures for each of the nine questions were normalized and averaged into measures of productivity and uniqueness for each subject. The productivity and uniqueness measures showed a .51 correlation, significant at the .05 level.

How productivity was related to the competency variables was examined. The half of the subjects in the high judged quality group were found to be more productive at the .006 level of significance. Productivity differentiated less strongly between the professionals and amateurs, the professionals proving more productive only at the marginal .08 significance level.

The relation between uniqueness and the competency variables also was tested. Uniqueness did not relate significantly to judged quality. However, the professionals tended to give more unique responses, a result holding at the .001 level.

It was gratifying to find such strong trends. Some difficulties of interpretation should be noted, however. First, while productivity related most strongly to judged quality, uniqueness related most strongly to professionalism. Since the judged quality and professionalism measures of competence must themselves be considered somewhat suspect indices of true competence, it is not entirely clear whether productivity, or uniqueness, or both in what mix, contribute to true competence. At least the results strongly suggest a relationship between fluency of some sort and poetic effectiveness.

Second, it should be noted that the association of productivity with judged quality does not imply that subjects conducted their poetry writing as though it were a series of fluency tests. As reported in section 3, study 2,

subjects generally did not proceed by generating large numbers of alternatives and choosing among them. Thus it remains to understand exactly how productivity would contribute to the ongoing process of writing so that a better quality product would result.

Study 2: Subjects' facility and its correlation with competence

The investigation sought to determine how readily subjects wrote and how that related to the quality of their products. Several factors recommended this interest. As already noted, biographies of certain notable artists disclose feats of fluent production, where major works were developed in remarkably brief periods. It is tempting to suppose that great facility is a sign of a special gift which would also manifest itself in unusually high quality. But the opposite can be argued just as well: the poet who spent more time usually might write better.

The investigation could not use the thinking aloud protocols to probe facility directly, since typically there was not time to bring a work to completion. Other resources had to serve. The subjects' own reports of the times poems typically took provided one measure. Here it was found that no poet claimed to routinely produce finished poetry from a blank page at a rate of more than about a half a line per minute. Only one poet reported this rate, most indicated considerably slower rates and some agonized over their works. (Reference to a rate does not, of course, mean that a poet would produce steadily at that rate, but that the figure would express an average). The question of rate also was pursued through biographical sources. The late L. E. Sissman had reported in print and confirmed in an interview which was part of this investigation a routine rate of a half a line per minute. Enough information was found about episodes in the lives of some other poets noted for their facility to estimate a production rate. The same finding of about a half a line per minute emerged. Finally, a number of interviews with poets were reviewed. Though calculating production rates was impossible, often the amount of editing the poet reported could be classified roughly. This showed the same drastic differences from poet to poet revealed by the subjects in the present study.

It should be noted that a rate of a half line per minute still allows ample time for puzzling over difficult lines, sifting through some alternatives, and so on. This rate does not approach rates associated with oral improvised poetry. Albert Lord reports from his studies of the oral epic tradition in Yugoslavia that an oral poet will improvise at a rate of from 10 to 20 lines per minute -- 20 to 40 times faster than the fastest rates found here. Of course, although his performance is truly improvised, the oral poet relies on stock phrases, standard plots and other supporting patterns. Even so, the comparison emphasizes how far short of truly improvisatory rates the fastest writers are.

6. Poets' general backgrounds, attitudes, and practices

As noted already, each poet was interviewed thoroughly. The interview was conducted verbally and fairly informally. Its course was guided by a questionnaire consisting of some fifty items. For most items, subjects' responses were categorized or scaled by judges. Where this was difficult, subjects' responses were surveyed and summarized.

It is helpful to think of the interviews as providing three kinds of information. First, they offer a general picture of the backgrounds and methods of the subjects as seen by themselves. Second, the interviews indicate deviations from the general picture. It is notable that in many respects little in the way of "typical poet" emerged, and that for almost all questions, one or two subjects veered substantially from the norm. Third, subjects' answers often allowed for testing for correlated differences in competence. The following series of summary paragraphs address the first two themes, deferring the competency question until the end.

Theme 1: History of involvement in poetry

A few subjects mentioned particularly traumatic backgrounds such as "disinherited by parents" but most did not do so. Most subjects commenced writing sometime near to their high school years. Several subjects reported the occasions which prompted them to begin -- an encouraging teacher, an older sister writing, a family move with associated feelings to express. There were no particularly remarkable instigating experiences mentioned, however.

The amateurs had been writing for an average of 8 years, with a standard deviation of 5. This confirmed the amateurs' serious long-term involvement. The professionals had been writing poetry for 19 years in the mean, with a standard deviation of 6. Formal training ranged from none to several experiences with courses, workshops, and so on. Two professionals reported no formal training at all. The professionals, of course, had published at least one book as a condition for participation. By the time the study was well underway, four of the amateurs had had works accepted in nationally distributed journals, more testimony that the amateurs were seriously committed. Four others had published in local journals.

Theme 2: Reading habits and models

The professionals averaged 19 hours of reading literature per week (sd 9), the amateurs 10 hours (sd 8). Thus with a couple of exceptions, subjects were serious consumers as well as producers of literature. Subjects readily named several poets whom they admired. There was great diversity: no poet was mentioned more than 3 times. A few subjects took pains to note that they didn't model themselves after the poets they admired. For most, the degree to which they saw themselves as doing so remained unclear.

Theme 3: Role of poetry in subjects' lives

In general, subjects indicated a very strong commitment to poetry. "I would rather be dead rather than not be able to write" was a fairly typical comment. However, one professional indicated a fairly offhand attitude. The reason for writing most often given was cognitive: a means of understanding the world and one's self. Other themes about half as frequent were the therapeutic payoffs, the joy of craft, the pursuit of excellence and reputation, and communication with others. Often poets mentioned more than one reason. Most poets reported being fairly but not wholly satisfied with their poetry. A few indicated total satisfaction or serious misgivings.

Theme 4: Subjects' objectives for their poetry

Poets were able to describe their aims for their poetry readily. These aims ranged widely, from getting published to pursuing particular themes to exploring various forms, and so on. The essential point is that subjects revealed a clear sense of direction. They were not just writing one poem after another.

The subjects were asked particularly about their concern with surface versus deep meaningfulness in their work. Slightly better than half indicated a strong concern with both, but otherwise there was an interesting polarization. A few felt that surface accessibility deserved emphasis and that deep meanings would take care of themselves. A few others felt just the opposite.

Theme 5: Productivity

Several questions probed how steadily and productively the subjects worked at writing. The professionals averaged about 6 hours per week, the amateurs 2.5. The professionals drafted a remarkable average of about 110 poems per year, the amateurs only 19. The figures for individuals varied drastically, however. Also, great variation was reported from occasion to occasion. A 'quick' poem might be completed in an hour or so, while a difficult one might require 40 or more hours and many sittings.

Theme 6: Working environment

The subjects revealed diversity in their typical writing situations. While a slight majority usually worked at home, others had other favorite places such as offices. While about half preferred silence, the rest didn't mind noise and some preferred a noisy environment. One preferred a public setting while four others were indifferent. Subjects often relied upon favorite accoutrements -- pencil, typewriter, thesaurus, dictionary, television going, music, drugs. The majority of subjects mentioned at least one accoutrement. Some would feel relatively strongly about such matters as writing with a pencil versus a typewriter.

Theme 7: The course of writing

Several questions probed the normal course of producing a poem. Since often poems required a number of sittings, the thinking aloud experiments did not provide such information.

Different subjects reported typically beginning in different ways: through the stimulus of a past event or current observations; from a kind of affective state which tended to yield up poetry, rather than or in addition to the prior; or by more actively harvesting one's experience for ideas and emotions. The subjects mentioned various phases in developing a poem: 1) mood/motivation/inspiration; 2) initial image, line, idea;

3) first draft; 4) leave the poem alone for a while, perhaps after some further work; 5) revise and revise. However, subjects only mentioned an average of three of these phases, and some were reluctant to name any. In short, subjects did not have any elaborated concepts of phases through which a poem might pass.

Subjects reported various moods while writing. Some mentioned an inspired state or a feeling of suspension, others a quiet reflective deliberate attitude, others excitement.

Subjects by no means regularly completed all their poems, though the majority would be finished. Again, some differences obtained from poet to poet and one professional finished only about a third of her work. Some subjects reported never or rarely starting a new poem before completing one underway. Others usually did so. The majority usually set aside a poem for a while, but three rarely or never did so. The professionals would not uncommonly set poems aside for nearly a year, but individual practice varied widely.

Besides setting a poem aside, subjects mentioned other tactics of distancing: asking for criticism (see below), typing a poem to objectify it, working on another poem, editing an earlier poem, reading poetry, stepping away physically for a few minutes.

Reasons for being done with a poem varied also: subjects mentioned considering others' judgments, finding nothing evidently displeasing, being tired of working on the poem, achieving a succinct, clean statement, and other criteria.

In summary, subjects reported considerably different moods and practices within the basic framework of advancing from a blank page to a completed poem.

Theme 8: The seeking and giving of criticism

About half sought criticism for nearly all their works, and several others did so occasionally. A few rarely sought criticism. Nine of the ten professionals and half the amateurs felt criticism to be helpful and indicated no misgivings. A few subjects indicated some disappointment and three amateurs had not found criticism useful at all.

In general, subjects sought criticism from peers or better poets. However, it is notable that two of the professionals intentionally sought feedback from persons relatively naive about literature.

Most of the subjects at least sometimes provided others with criticism. Nearly three-quarters claimed to offer intensive coverage of at least some specific aspects of a poem. It should be noted that this is

inconsistent with the sketchiness of subjects' remarks on the poem given them for criticism (see Section C 1., Study 1). Three professionals and two amateurs claimed absolute candor in offering criticism, while the others admitted to exercising tact to various degrees.

The subjects handled criticism rather differently. Some claimed to meet it head on and make the most of it, while others found it upsetting and difficult to deal with. Various tactics were mentioned for distancing oneself from criticism to use it effectively -- time away from the poem, reflection, consultation with another critic.

In general, despite the sensitive nature of criticism, and despite a few exceptions among the subjects, it seemed clear that getting and giving criticism was an important part of the subjects' literary activities.

Summary picture of the poets

It is reasonable to ask whether so diverse a mix of questions and answers could be expected to yield any general conclusions. But some conclusions do seem possible. First of all, there is abundant evidence for the seriousness of the poetic enterprise. This includes the subjects' own statements of its role in their lives, time spent reading and writing, efforts to seek criticism, duration of involvement, and so on. Given that many people are not that attached to their professions, it is notable that most of the professional poets were, and passionately. This is not so surprising in that poetry is an endeavor of meagre worldly rewards. But somewhat more surprising is that the amateur group showed nearly as much commitment. Of interest in itself, this also shows that the thinking aloud study examined amateur performances reflecting a serious, not an idle, involvement in poetry writing.

Another general point is that the interview data frequently contradicted the romantic stereotype of a poet. While some poets reported writing from inspiration, others gave rather different accounts. Certainly on the whole, the subjects worked long and hard to complete their poems. Not so insular, they actively sought criticism. While a few were relatively indifferent to surface clarity, most thought it important. And so on. In all, the romantic stereotype of the inspired, self-involved, spontaneous, obscure creator did not survive very well. This is hardly amazing, but there is some value in documenting it.

As important as the weakness of the old stereotype is the failure of a new one to emerge. True, some generalizations can be made concerning high commitment -- or interest in criticism. However, in their histories, models, moods, procedures and so on, as often as not the subjects scattered widely. When a strong trend emerged, almost invariably there were exceptions. A crucial question remains, however: was there any basis for identifying among this diversity the 'true' poets, those whose pattern of attitude and behavior reflected a strong gift?

Competence and the interview results

The relation between the interview responses and the competency measures was examined. Fourteen variables derived from the interview responses were selected. For each variable, a higher score was predicted for more than for less competent poets. The bases for the predictions were commonsensical. It was thought that competence might be related to experience (e.g., number of years writing), effort (e.g., time investment in writing) and attention to criticism (e.g., rated worth of critical feedback).

A series of t-tests compared the high and low quality groups on the 14 variables. In 4 cases, a statistically significant difference was obtained, always in the predicted direction. Most notably, the high quality grouped averaged 3.1 classroom or tutorial experiences, the low quality group only .7. This result was significant at the .004 level, 1-tailed. Also, the high quality group rated feedback as more useful ($p<.01$), solicited feedback on a greater percentage of their poems ($p<.03$) and spent more time writing the poems on which they worked the longest ($p<.02$).

Besides the individual tests, a general trend deserves note. Only one of the fourteen comparisons did not fall in the predicted direction: The high quality group had slightly less experience than the low quality group by a fraction of a year. If one assumes the 14 tests to be independent (they are not entirely so), this result in the ensemble is highly significant (binomial test, $p<.001$ one-tailed). That is, though one cannot rely on any of the individual comparisons that did not reach significance, collectively they characterize the high quality group.

Exactly the same comparisons were made between the professional and amateur groups. T-tests revealed 7 significant differences. Unsurprisingly, the professionals on the average proved to have spent considerably more years writing ($p<.001$, one-tailed) and to write several times as much and for more than twice the hours per week ($p<.009$ and $<.008$ respectively). Of somewhat more interest, the professionals set their poems aside for much greater periods of time ($p<.002$), spent about twice as much time reading literature ($p<.024$), rated feedback to be more useful than did amateurs ($p<.042$) and were less concerned that a poem have an accessible surface meaning ($p<.034$, two-tailed). The latter result was contrary to prediction and to a non-significant trend in the high quality, low quality comparison.

Despite the several significant contrasts, overall the professional-amateur comparison did not conform to prediction as well as the prior one. Of the 14 tests, only 9 differences were as predicted. There were two ties and three contradictions, one significant individually as noted above.

In general, the professional-amateur comparison showed a stronger contrast on variables related to effort than did the high quality-low quality comparison, and a weaker contrast on variables related to seeking criticism. Nevertheless, both trends appeared in both comparisons. It seems reasonable to conclude that both hard work and feedback from others through courses and sought criticism relate to higher competence as measured here.

However, there is some risk in concluding that the best poets are those that take courses in poetry writing and seek out criticism. Such behavior could be expected to move poets toward contemporary norms for poetry writing. The competency variables would be affected in the same way: poets become professionals and poets judged to be of higher quality are so appraised in part because their poetry accords more with contemporary norms. So the supposed competency measures might merely indicate a pernicious conformity.

However, that is far from clear. Research in the visual arts, as well as everyday observation, shows that originality is itself a norm. Professional ratings of quality relate closely to originality. Plausibly, the same applies to poetry. Also, outside of classroom situations, poets select those from whom they receive feedback, and therefore whether the poet conforms to his readers or chooses his readers to conform to him is in question. In short, the present results suggest that effort and feedback relate strongly to a poet's producing what are taken to be poems of quality. The ultimate validity of that measure is beyond the scope of this study.

7. Related studies outside the arts

Study 1: The nature of insight in puzzle solving

It was hoped that the poetry experiment would yield information about moments of insight such as are prominent in autobiographical reports of creative individuals. This was so only to a limited degree. One signal of such events would be the subjects' own exclamation. In fact, there were relatively few such exclamations among the transcripts. Also, the most dramatic of these, closely analyzed, revealed considerable continuity of thought despite the subjects' reaction.

This in itself is information about mental leaps. It suggests that in fact unambiguous examples are scarce in workaday creative activity. However, that conclusion discloses little about the character of mental leaps when, and if, they do occur.

A separate study was undertaken in hopes of generating more authentic occasions of mental leaps. The study used popular insight problems -- puzzles which tend to be solved in a moment of insight if at all, or at least so it seems. Eight subjects solved four insight problems each. If a subject had spent more than five minutes on one problem, he

was shifted to another. As soon as a subject achieved a solution, the experimenter asked the subject to recall the steps leading up to the solution. The method was an elaborated version of the retrospective procedure described earlier. The investigator probed the subjects' initial account in various ways, inquiring step by step whether the subject was sure he remembered the reported event, whether any intervening events could be recalled, and so on. The resulting protocols were analyzed for the patterns of thinking which led subjects to their solutions.

Unambiguous mental leaps appeared hardly more often than in the poetry experiment. Even when there were expressions, there would be apparent continuities in the course of thought. Out of the 40 protocols gathered, about 8 were considered somewhat leaplike in character, but only a couple seemed clearly so.

Of more substance than any simple tally of mental leaps according to somewhat vague notions of continuity was an examination of just how subjects solved the problems. Here the circumstances proved remarkably varied. In some cases, subjects detected a key phrase in an insight problem, a phrase which seemed too general or specific or convoluted for the surrounding problem text. This often sounded out of place precisely because it had been so framed as to create an ambiguity which would allow the intended solution. Detecting such a phrase, subjects would then discern what the phrase concealed and reach a solution, often quite abruptly. On other occasions, subjects would reason their way to a solution by eliminating possibilities. There were even occasions where a subject attained the essential idea of a solution, did not recognize it as such, and left it only to rediscover it later.

The data are still under analysis and a comprehensive account of these variations remains to be achieved. However, it seems clear that pattern recognition plays an important role in recognizing key phrases and the potentials of particular approaches. The sudden character of pattern recognition seems to come close to the supposed accomplishment of mental leaps, and some of the more leaplike episodes can be understood as occasions of, or substantially involving, pattern recognition.

Other episodes, however, would seem to be better explained by a parallel with contemporary models of understanding language. In certain of those models, various inferences are automatically drawn from the content of the linguistic input, compared to, and added into the existing knowledge base. This process goes beyond recognition as such, since it involves not simply classifying a linguistic input into a preexisting category, but constructing a unique addition to the current knowledge state. It is tempting to speculate that this sort of automatic inferential process is involved not only in the understanding of everyday speech, but in moments of insight as well.

Both these interpretations suggest that moments of insight are

experienced as such not because any particularly exotic mental process has occurred, but because workaday mental processes of recognition and understanding have yielded a sudden happy result.

Study 2: Noticing in mathematical problem solving

(summary of Noticing: An aspect of skill. D. N. Perkins, in Conference on basic mathematical skills and learning, volume I: Contributed position papers, Washington DC: National Institute of Education, 1975.)

An analysis was undertaken of an aspect of skillful problem solving in mathematics and the import of this for mathematics education. It was proposed that skillful problem solving depended in large degree upon noticing. Noticing was a name for a commonplace perceptual phenomenon: one often recognizes something significant even though not looking directly for or at it. Skillful problem solving in mathematics seemed to depend in significant part on noticing relevant approaches rather than upon systematically examining what approaches might apply. The skilled problem solver needed to draw upon a large repertoire of possible approaches, a repertoire that could not conveniently be reviewed piecemeal. Rather, he had to depend on a pattern recognition capacity to scrutinize the problem and detect a relevant approach. An analogy could be made with studies of chess playing, where chess masters have been found to depend on a very large 'vocabulary' of typical configurations of pieces and patterns of play, accessed by a rapid perception-like process.

It was suggested that mathematics education should consider the role of noticing. Typically, education exercised problem solving in problem sets adjacent to the explanatory material. Just which approaches to take were narrowly constrained by the context. Students encountered few circumstances where they faced a problem without a narrow helping context. Also, students experienced little practice in discovering occasions outside the classroom where their knowledge might be applied. It was suggested that mathematics education could provide tasks capturing such circumstances, tasks which would build students' noticing abilities and impart more flexibility in their use of their mathematical knowledge.

8. Summary conclusions concerning production

Any summary here is bound to be premature. The protocols gathered offer a nearly inexhaustable resource for investigation, and inquiry is continuing. Nevertheless, some sort of overview is in order.

Certainly a key point is this: poets' moment-to-moment accounts of their thinking have proved remarkably intelligible. One can read such an account and understand what the poet was about. When there are gaps, for the most part they are gaps not where one is faced with the ineffable nature of artistic making but where the poets' motion from A

to B seems entirely plausible -- the sort of step one might expect a mind to take in any sort of a thinking situation. Against the background of mystery-making in the arts, the sheer intelligibility of the poets' thinking is an interesting finding.

In more specific ways as well, one product of the effort has been an empirical critique of popular visions of the poet. The findings flatly contradict many stereotypes. The thinking aloud showed poets to have access to processes often thought to be entirely unconscious. Creation proved highly goal directed: poets most often produced phrases with particular purposes in mind. However, they detected difficulties largely spontaneously: instead of production being the more spontaneous process and criticism the analytical one, just the opposite appeared. The interviews revealed no typical poetic background, a very unegocentric respect for and pursuit of criticism, only occasional disdain for surface accessibility, and so on.

Another outcome has been a profile of the process by which the poet achieves a poem. For example, persistent reworking seems typical. Effects are not usually accomplished through extended trial and error at one time: rather the poet is able to think of something which seems to him apt for the moment. Attention characteristically is directed most toward superficial meaning and toward unity and originality, with other concerns nevertheless receiving considerable attention. Many of the points from the prior paragraph could be listed here, also.

A third outcome is some differentia between more and less competent poets, differentia to be viewed cautiously in light of the difficulties with an adequate competency measure. The more competent poets appear to work somewhat harder, writing more poems, puzzling over the more difficult poems longer and so on. They are more socialized in their craft, having had more educational experiences in poetry and valuing and seeking criticism more vigorously. The more competent poets also exhibit greater fluency on formal fluency tasks.

This information comes from sources other than the thinking aloud protocols. As so far analyzed, the patterns of thought in the protocols have not revealed distinctions related to competency. There is a hint that a greater concern with originality and less attention to content might correlate with greater competency, but these trends were not sufficiently consistent or significant to warrant a conclusion there.

It is possible that the thinking subjects are able to report does not relate particularly to competence. Such a finding has emerged in studies of chess play, where skill apparently does not reside in how far ahead a person thinks. Measures of this have failed to distinguish between masters and mediocre players. Rather, skill depends in large part on the ability gained from long experience to recognize significant patterns of pieces and appropriate courses of action. This "noticing"

ability, relevant to mathematical problem solving as discussed earlier, also can be expected to figure importantly in poetry writing. The place for some such thing is apparent from the present analysis: it will be recalled that evaluative reactions were largely spontaneous rather than narrowly directed. That means that in monitoring his own progress, the poet principally depends on a diffuse focus which must reliably detect whatever really needs attention and ignore what does not.

Certainly the writing of poetry remains a much more mysterious activity than some narrower and more formally defined tasks such as the cryptarithmatic problems that have been studied with 'think aloud' techniques by Newell and Simon. There, working from protocols, it was possible to reconstruct rather well the course of an individual subject's thought as a computational process depending on primitive operations which could, if desired, be computer-simulated rather readily. Here, however, the greatest part of the 'fit' between production and poem-so-far is achieved by rapid covert mechanisms that work to meet whatever constraints are explicit plus the many that are not.

This is hardly surprising. Language production in general is a relatively rapid process, difficult to track through reports of thinking and difficult to model because of the enormous semantic resources of the speaker and the subtlety with which he taps them. Contemporary research on language production and understanding is making steady progress there. In one way, the production of poetic language is easier to study: the demands of the situation cause the poet to stretch out the process so there is more apparent deliberation, revision, and so on. But on the other hand, the poet's productions draw all the more on the nuances of those semantic resources which are so hard to model.

From an educational standpoint, the most obvious import of these studies has been that hard work, formal training, and the seeking of criticism correlate strongly with poets' apparent effectiveness. Of course, correlation is not causation. Still, it is most plausible that these contribute quite directly to a poet's ability to produce works having significant poetic quality according to contemporary standards. This suggests that education already plays an important role, and that education can pursue ways to encourage effort and to foster appreciation of the benefits of criticism and techniques for making the best use of criticism. Some further problems and opportunities in this area are discussed in the paper "Talk about Art," described in Section C.3., Study 1.

Of course, the dangers of parochial standards and narrow conformity have to be kept in mind, as noted earlier. Appreciation for the helpfulness of criticism need not imply uncritical acceptance of anything anyone says. How to teach students to navigate between too rigid and too pliable a posture toward criticism is certainly a delicate problem.

To this point, handy formulas for poetic creation have not emerged

from the research, nor were such expected. However, the inquiry offers another sort of lesson: providing a fairly close look at the variety of approaches poets take, the effort they expend, the degree to which they deliberately address and resolve problems, and so on, the present findings may have use in some form as information for students in any of the arts, information which will correct some stubborn entrenched assumptions about artistic activity and allow students better to get on with the pursuit of their art. In a course based on this and other Project Zero research and taught several times, there seems to have been some payoffs from a better understanding of the character of artistic making (see Section D.5. for a brief description of the course).

C. Studies of Critical Response

1. The competence of criticism

The study of poets was used as one occasion to investigate criticism as well as creation. This inquiry proved particularly apt for two reasons. First, the interviews with the poets revealed that most provided criticism to others at least occasionally. Thus, examining their criticism would be examining an activity they normally performed. Second, the effectiveness with which a poet was able to comment on others' works might relate to his effectiveness in criticizing his own, and hence to his competence as a poet.

Each subject was given a fifty-line, six-stanza poet to critique. A professional poet contributed the poem. The investigators altered the poem to make two of the stanzas dull, and to introduce bizarre and obscure phrases into two others. This was done cautiously so that no such pattern was blatant. Each subject was asked to criticize the poem as he would for a peer or student. His criticisms were recorded.

Preliminary to a more particular analysis, each remark was coded in four ways. First, the lines a remark referred to were noted -- some comments referred to one line (in whole or part), while others might span several lines or the entire poem. Second, the positive or negative weight of a comment was scored on a seven-point scale. Third, if any critical principle was referred to, that was scored. The thirteen categories of critical principles mentioned in Section B.4., Study 3 were used. This included such categories as unity, originality, clarity. Finally, if a comment addressed a particular aspect of the text of the poem, that aspect was scored. As related in Section B.4., Study 4, aspects included 13 categories such as rhyme, soundplay, meaning, form. These four ways of coding each comment provided for the analyses to be described below.

The results from Studies 1 and 3 are discussed as part of the paper Talk about art, D. N. Perkins, Journal of Aesthetic Education, 1977, 11 (2), 87-116; and in S. Madeja (Ed.), The arts and aesthetics: An agenda for the future, St. Louis: CEMREL, 1977.

Study 1: Profile of critical competence

To what extent did the subjects offer adequate critical appraisals of the poem given them? This question was approached in several ways, all suggesting that on the whole, the critiques would not have been at all optimally helpful for the poem's supposed author. Subjects averaged only 8.75 'focused' comments, comments not addressing the whole poem. The minimum was two, the maximum seventeen. Comments addressed from one to five lines at once, with an average of 2.6. Such criticism certainly could not be considered detailed for a fifty line poem. Also, this criticism was not as detailed as the criticism most subjects purported to give in their interviews (see Section B.6, Theme 8).

On the whole the criticism did not range widely over the principles and aspects. The average subject mentioned about 5 principles and addressed about 3 aspects, the ranges being from 1-9 and 1-6 respectively. This, of course, is in keeping with the relatively small number of comments: there would be little room for the subject to raise varied considerations.

Study 2: Relation of critical competence to competence in poetry writing

Various tests were undertaken to determine how performance on the criticism task related to the competency measures of subjects as poets. By far the strongest finding was that remarks by professionals tended to be more localized, referring to very particular places in the poem ($p<.007$). Other than that, over a number of tests, the distinction between professionals and amateurs yielded only a couple of marginally significant trends. Professionals tended to make more comments ($p<.08$), and to range more widely over the principles ($p<.08$), a partly redundant result.

The high quality group also tended to make more comments ($p<.06$) and scored better than the low quality group on two composite measures of the competency of the criticisms ($p<.05$). The professionals showed the same trend, but only at the .12 level and for just one of the composite measures. In appraising these results, it must be remembered that a number of tests were performed and that one or two of these results could be spurious.

In all, the tests suggest some relationship between being a good critic and a good poet as here measured. But it must be stressed that this relationship is quite weak. The few trends expressed above still allowed a subject scoring well on the composite measures of critical competency to fall into the amateur or low quality groups nearly as often as into the professional or high quality groups. No simple position that the best poets are, because of that, the best critics, or the best critics, because of that, the best poets, can be maintained. Even less viable, of course, is the idea that the best critics are, because criticism is "academic," the worst poets. The findings lean in the opposite direction.

Study 3: Critical divergence

This analysis sought to appraise the degree to which subjects apehended the poem in the same way. For instance, although subjects made relatively few comments, perhaps most of them made the same several most telling comments. One encouraging sign of this appeared: as a group, the poets did detect the ways in which the poem had been rigged. Pooled over subjects, the critical principles clearly showed the pattern of bizarre and dull stanzas in the rigged poem.

The issue of a common perspective was examined more carefully by testing whether subjects mentioned similar principles and aspects in association with the same lines of the poem. It is most convenient to describe the results by comparing one hypothetical average subject with another. Tabulations disclosed that 65 percent of the one subject's remarks would concern the same line as the other. Also, 31 percent would address the same line in the same aspect. Just 13 percent would address the same line in terms of the same critical principle.

Small enough as they are, these figures overestimate the commonality. Comments classified into the same aspect or principle did not always make the same point, a spot check revealed. Also, although many remarks spanned several lines at once, subjects were credited with a common remark in the above analysis if their comments overlapped at all.

It had to be concluded that subjects were responding to the poem rather differently, not just in their summative opinions but in the parts, aspects and relevant principles they singled out for mention. The findings raised the possibility that critical disagreement might stem as much from partially sampling the complex work of art as from divergent standards as such. Studies described below pursue this issue further.

2. The sources of critical disagreement

Critical disagreement is a commonplace event in discourse about art, so much so that many people construe judgments of works of art to be fundamentally idiosyncratic and subjective. Ordinarily, critical disagreement is attributed to different people having different standards. However, the foregoing finding pointed to an important alternative source of critical disagreement and recommended a careful effort to define and measure such sources. Perhaps the problem of critical disagreement would prove more tractable than it seemed, if only its causes were understood.

This theme was pursued through the following four studies, and further experimentation is underway. The studies are discussed further in: Are matters of value matters of fact? D. N. Perkins, to appear in a volume drawn from the conference What is a Painting? Philadelphia Museum of Art, Philadelphia, Pennsylvania, April 17-19, 1978, editors Dennis Fisher and Calvin Nodine.

Study 1: Effects of enhanced attention on disagreement

The above finding as well as other observations suggested that a sampling problem might contribute to critical disagreement: Works of art were sufficiently complex that different persons would register somewhat different features and base their evaluative conclusions on somewhat different perceived works.

If this were so, a treatment which encouraged more extensive perceptual sampling ought to enhance agreement. An experiment was designed to test this hypothesis. The study used four pairs of drawings. The drawings of each pair were slight variants of one another, variants designed to have aesthetic significance. The pairs were selected from the Meier Art Tests, part II. There were two groups of twelve subjects each, a control group and a treatment group. A subject from the control group simply considered each pair and chose which one he thought to be the best artistically. A subject from the treatment group first wrote a list of reasons why one of the sketches was better. Then he did the same for the other sketch. He was encouraged to get into the task as much as possible, role-playing a defense of both sides. In addition, the instructions for each pair of pictures mentioned two or three dimensions along which comparisons might be illuminating.

Trial and error had convinced the experimenters that this treatment, among several alternatives, was most likely to acquaint the viewer with multiple aspects of the work and different perspectives on it. The prediction was that the viewers in the treatment group would agree more among themselves than the viewers in the control group. The prediction was not confirmed. In fact, more diverse opinion appeared in the debate group than in the control group, at a marginal level of significance.

Study 2: Attempt to confirm the foregoing results

The above hint that enhanced attention might aggravate critical disagreement needed checking. Such a finding would be of great import. Therefore, a second experiment was designed in hopes of confirming this result at a higher level of significance. To this end, a somewhat different procedure was used. The same four pairs of drawings provided the stimuli. This time, however, the subjects made initial snap judgments for a pair of sketches. Then ten of the subjects undertook the debate procedure as described above. Another ten simply listed as many contrasts as they could between the two sketches. Finally, each subject made a final, more considered choice.

The analysis compared agreement in snap judgments with agreement after treatment, by groups. If the trend of the prior experiment continued, the debate treatment and perhaps the comparison treatment would produce more disagreement after than before treatment. Also, the analysis compared agreement across the two treatments. Since the experimenters had thought the debate treatment to be the stronger one, perhaps in

keeping with the prior finding, it would yield the most disagreement. In fact, no trends even approaching significance appeared. Disagreement was neither significantly aggravated nor reduced.

Involving a relatively small number of subjects and only four pairs of drawings per subject, these experiments were not sensitive measures of the effects of enhanced attention. For instance, in the second study the treatments led subjects to change their initial judgments about 25% of the time, that is, in about 20 cases. A trend toward more or less agreement after treatment would need to be strong to reach statistical significance. Accordingly, the present findings provided evidence against dramatic effects of close viewing of art, but not against more modest effects.

Study 3: Effects of enhanced attention on spread and confidence

In light of the above limitations, a way was sought to investigate effects of the treatments without addressing disagreement as such. Subjects had been asked to provide, with each judgment, ratings of the two drawings on a 100-point scale. In addition, subjects had been requested to rate their confidence in their choice. For the second experiment, the quality and confidence ratings were obtained both for the initial 'snap' judgments and the judgments after treatment. If the treatments succeeded in expanding the ground for subjects' judgments, one would expect the 'after' judgments to show more spread in quality and more confidence than the 'before' judgments. The data from the second experiment was analyzed to ascertain whether this was the case.

The results differentiated between two of the stimulus pairs and the others. For two, agreement both before and after treatment had been relatively high. For the other two, agreement had been low. The analysis showed that on the 'before' judgments, there was no difference between the spreads and confidences for the high agreement and the low agreement pairs. However, the 'after' judgments showed greater spread and confidence for the high agreement drawings. The spread for the low agreement drawings remained unchanged. The confidence for both low and high agreement drawings increased after treatment. The results were significant at about the .03 level, 1 tailed binomial tests.

These findings suggested that the treatments helped subjects toward better grounded judgments, but only for the high agreement drawings. Apparently, the low agreement drawings were genuinely confusing -- closely matched in their assets and deficits. Thus, enhanced attention did nothing to resolve the confusion. However, it is important to note that the low agreement drawings were not thought to be any more confusing than the high agreement ones during subjects' initial judgments.

Neither quality nor confidence ratings are the same as agreement. Nevertheless, it is plausible in light of the above findings that a larger sample would show significantly more agreement on high-agreement sets of

drawings as a result of the treatments. Such a finding would support the notion that critical disagreement stems in significant part from sampling difficulties, providing the value of the work is not rather ambiguous in the first place.

Study 4: Alternative standards versus other sources of disagreement

The data from Study 1 above provided an opportunity to learn something about the relative contribution of alternative standards and other sources of critical disagreement. The data were analyzed to this end. It will be recalled that two or three dimensions of fruitful comparison had been suggested for each pair of pictures. However, which end of each dimension was to go with which picture was not indicated. For instance, consider the dimension clear-ambiguous which went with a pair of pictures. One subject might identify one of the pair as the clear one, and another subject the other of the pair. But also, one subject might value one or the other picture for its clarity, while a different subject valued or or the other for its ambiguity.

A content analysis was carried out, determining what evaluative disagreements occurred, what if any of the given dimensions the subjects mentioned, which end of the dimension they associated with which picture, and which end of the dimension they valued. Thus, when two subjects disagreed, it was possible to determine whether they described the pictures in the same way (associated the ends of the dimension with the same pictures) but valued opposing qualities in this case, at least, or whether they valued the same qualities but described the pictures differently.

It was found that subjects' disagreements stemmed nearly as often from descriptive differences as from differences of valuing. This provided evidence for the hypothesis that differing standards were not the only important source of critical disagreement; rather, the works were differently perceived. In some cases, this clearly amounted to contrasting perceptions of the very same parts of the pictures. For instance, some subjects identified the expression on a pictured face as emotionally neutral, others as deeply troubled and disturbed. In other cases, the descriptive difference clearly reflected attention to different parts of the pictures, another manifestation of the perceptual sampling difficulties discussed earlier. It was not possible to assess the overall balance between these two sources of descriptive difference.

3. Difficulties in critical judgment: three overviews

Besides the laboratory studies reported above, some broad positions on the character and problems of critical judgment have been formulated. This work has drawn to a degree on the laboratory studies, while at the same time taking into consideration informal observations and philosophical insights. The summaries below concern and nature and difficulties of critical discourse, the problems of encountering novel art forms, and the possible sources of divergent interpretations of works of art.

Study 1: Talk about art

(Talk about art, D. N. Perkins, Journal of Aesthetic Education, 1977, 11(2), 87-116; and in S. Madeja (Ed.), The arts and aesthetics: An agenda for the future. St. Louis: CEMREL, 1977.)

This interpretive study analyzed the adequacy in principle and practice of talk about art. As to adequacy in principle, popular attitude often held that discourse about art could not say very much worthwhile. However, the reasons for this attitude were found wanting. There were no grounds to expect talk about art to re-create experiences or comprehensively describe them. Talk virtually never accomplished this in any domain. On the other hand, significant assertions about works of art could be made. There were no obvious limitations as to what aspects of art such assertions could deal with. Finally, talk of this sort could guide persons' experiences of works by directing attention to crucial features.

Sometimes discourse appeared fruitless because disagreement was so common. But it was argued that discourse was hardly the cause of disagreement. On the contrary, talk was a powerful tool for sometimes achieving agreement and at any rate sorting out the real roots of disagreements.

This positive view of what talk about art could do in principle contrasted with a negative assessment of talk in practice. Dialogue about art seemed often subject to varied lapses -- one party not answering another's point, claims with objective and subjective intent not distinguished, disagreements not pursued back into the reasons for them, censoring and defensive attitudes which impeded effective communication. There was ample opportunity for people to be educated to talk about art more effectively.

Study 2: Confronting novelty

(New art and the abominable snowman, D. N. Perkins, Art Education, 1977, 30(1), 13-16.)

Another interpretive effort took as its occasion an exhibition of conceptual art at the Harvard Graduate School of Education. Informal observation of the difficulties many people had in dealing with the works led to an examination of the problems of confronting novelty in art.

The exhibition posed formidable problems of orientation. Many people were at a loss as to how to approach the works and were inclined to dismiss the works across the board. They would have viewed works of a more familiar genre armed with some knowledge of: 1) which features were important and which were not; 2) where the boundaries lay separating the work from what was not the work; 3) what styles, periods, etc., comprised the genre; 4) what technical means served the genre; 5) how works were

made; 6) the ground rules for being an audience member -- what one looked for, how long one looked, and so on; 7) what artistic standards bore on the quality of the work; and 9) how standards centered in other disciplines bore on quality. The exhibit, and innovative art in general, crossed conventional boundaries in one or more of these areas and left the audience member poorly grounded for his encounter with the work.

On the one hand, it was felt that many viewers showed little awareness of the problem. They did not expect such difficulties nor attempt to cope with them. On the other hand, it was suggested that education in general and in the arts had not done much to prepare people for the peculiar problems of novelty, not only in the arts but in general. There was a kind of sophistication to be learned about the difficulties of confronting novelty, and education would do well to impart it.

Study 3: Interpretive disagreement and cognitive theories of the arts

(The significance of interpretive disagreements for cognitive theories of the arts: A response to Anita Silvers. In S. Madeja (Ed.), The arts, cognition and basic skills. St. Louis: CEMREL, 1978.)

The frequency of interpretive disagreement often is taken to argue for the noncognitive character of art. It seems implausible that the work of art is saying or meaning any definite thing or imparting or exercising any definite sort of knowledge when people so often diverge in their interpretations. However, a conceptual analysis disclosed that the implications of interpretive disagreement are not as strong as they might seem.

First of all, disagreements often might reflect factors quite compatable with that cognitive approach which maintains that a work symbolizes, or, more informally, "says" something. Many disagreements might be resolvable in principle to determine what the work 'says.' In other cases, a disagreement might be superficial, reflecting an ambiguity the work purposefully symbolizes. Some works might simply be confused in what they mean to "say." There was some room for legitimate interpretive divergence in that performing works such as symphonies allow for more than one interpretation which is true to the work. Beyond this, however, radical ambiguity and failure to be able to communicate about alternative experiences of works, when such occurred, would argue against an account of such works as symbolic.

However, there were other senses in which works could involve cognition. Even if a work symbolized nothing definite, one could come to know it in other ways -- in its varieties of indefiniteness, for instance. Furthermore, a work could impart knowledge in various manners, for instance by exercising one's understanding of the matters or forms the work dealt with. Since disagreements could be benign in several different ways and 'cognitive' could mean any of several different things,

interpretive disagreement left ample room for a cognitive perspective on the arts.

4. Errors in everyday reasoning

Another line of inquiry reasonably can be grouped with the prior investigations, although it did not directly concern critical judgment in the arts. Rather, it addressed the critical appraisal of alternative positions on a social issue and the construction of arguments favoring one side or the other. The study collected such arguments and sought to classify any lapses in reasoning. This study was supported principally by the Spencer Foundation, and will be described here only briefly.

The goal of the inquiry was to make progress toward ascertaining what kinds of errors of reasoning troubled everyday thinking. Both a philosophical tradition concerning errors in reasoning and a psychological tradition of laboratory research on reasoning have questioned the human capacity to reason effectively. The latter has proposed sophisticated information-processing models of the somewhat inadequate strategies people employ. But these traditions notwithstanding, there has been little assessment of whether the difficulties identified actually prove troublesome in realistic contexts of reasoning.

The present investigation began with an adventitious source of data. It proved possible to obtain from a popular magazine the letters which readers had written in response to feature articles on television violence. The issue was: did television violence affect our society adversely? A considerable number of letters were received, some arguing one side of the case and some the other. Twenty of each were selected for close analysis. To these were added twenty arguments on the same issue solicited from individuals around Harvard University and twenty arguments solicited by phone from residents in the Boston area. Subjects wrote their responses, and so had ample time to make considered arguments.

An analysis of inductive aspects of the arguments was undertaken (An appraisal of deductive aspects is planned). Commonly subjects would advance personal observations, newspaper reports of incidents, or generalizations about friends, classmates, and so on, as inductive support of their positions on the issue. Several scales were developed for rating the adequacy of the inductive support subjects offered. Each argument was scored on these scales independently by two judges, adequate interjudge agreement was achieved, and any disagreements were discussed until solved.

The investigation disclosed several frequent lapses of logic. No differences emerged among the three subject groups, although the relatively small sample sizes meant that such differences would have to be substantial to be detected. Among the errors identified were the following. Subjects tended to exaggerate the number of instances they plausibly would have been able to observe in advancing empirical claims, and to

report effects such as states of mind that they would have difficulty in observing. Sometimes cases would be offered in support of the general contention which were not 'fair samples' of the circumstances to which the general contention would apply. Two other difficulties proved by far more frequent however. First of all, subjects would very often generalize on the basis of very small samples, sometimes arguing from themselves as the only examples. Second, subjects' arguments would often allow a challenge of 'alternative cause.' Subjects would advance occurrences supposedly attributable to the influence of television violence, but for which alternative causes could be proposed easily. The former recalls difficulties identified in laboratory research by Tversky and Kahneman, as well as others. The latter finds close parallels in the writings of Piaget, Kuhn, and Wason and Johnson-Laird. Accordingly, the study was able to disclose in informal circumstances problems closely related to those which have emerged in more formal studies with relatively artificial tasks.

5. Summary remarks on critical response

It is useful to think of the above inquiries as cutting two ways. First, they may be considered studies of how well people perform in various critical contexts. The general answer is: not nearly as well as they might. The studies have noted such lapses as very incomplete critical appraisal, sparse perceptual sampling of the work, failure to communicate effectively about works, difficulty in dealing with novelty, and so on. In many respects, the difficulties are straightforward.

There is every reason to think that educational tactics matched to the particular problem could do much to elicit better performance. Courses on any of the arts might deal quite directly with the problem of encountering novelty, the difficulties of perceptual sampling and the likely consequence of critical divergence, or the sorts of misunderstandings that plague dialogue about works of art. For the most part, art courses concentrate nearly exclusively on the art and its historical context. One would not want to change this drastically; after all, it is the art that is under study. However, somewhat more attention to the psychological processes associated with viewing and discussing art ought to reduce some problems which are rampant in considerable part only because they are not addressed.

The practical difficulties of critical response aside, there is a second way the foregoing studies might be considered.

They bear on the possibility-in-principle of objective criticism. That is, if all the performance problems were settled, would there be enough of a consensual basis left to make critical judgment a reasonably objective enterprise? On the one hand, it was concluded that the resources of language do not of themselves pose the limits they are often thought to. Beyond that, however, it was difficult to assess whether objective criticism was possible. The many sources of disagreement

identified were not encouraging, but none were in principle intractable. It remains a real empirical issue how much of a common and penetrating perception audiences of art might achieve.

Questions of this sort are hardly limited to the arts. Many areas of human thought and effort involve great complexity and nuance. Problems of perceptual sampling, ineffective discourse, and so on, arise in such areas as well. Certainly they arise in reasoning about social issues, such as in the arguments examined concerning the debate about television violence. Also, discerning the nature of a social interaction or an individual's personality can pose such difficulties. In such cases, epistemelogical concerns parallel to those about the objectivity of value judgments can arise: how objective is a person's personality as casually perceived? Thus the present studies relate not just to artistic phenomena, but to generic human difficulties of perception and discourse in trying to construct and maintain a consensual reality.

D. General Perspectives

Besides the foregoing studies on particular issues, there have been several articles and other expressions of the research and its import for education. These are summarized below.

1. Probing artistic process: a report from Harvard Project Zero. D. N. Perkins, Journal of Aesthetic Education, 1974, 8 (3), 33-57.

This article surveys several lines of investigation conducted by various members of Project Zero. The last two sections integrate the approaches under two themes: the artist's use of his own perceptions as a model of his audience's perception, and the difficulies of self-perception and calculated change in learning a complex activity such as making art.

2. Project Zero -- moving from zero to one. D. N. Perkins and Howard Gardner. Harvard Graduate School of Education Association Bulletin, 1974, 18 (2), 5-10.

This brief article gives several illustrations of Project Zero's work.

3. Theory in arts education: The pound of feathers and the pound of lead. D. N. Perkins, Journal of Aesthetic Education, 1977, 2 (1), 5-18.

This article argues that the theories held about the nature of artistic activity substantially influence how arts education is conducted; that everyday attitudes about the arts reflect tacit theories; that theories much better than the everyday ones are possible; and that one might as well recognize the fact that theories are here to stay, and be sure that one is working with good theories. Specific examples are drawn from Project Zero research and implications for arts education are drawn.

4. The arts and cognition. D. N. Perkins and B. Leondar (eds.). Baltimore: Johns Hopkins University Press, 1977.

This book is a collection of twelve articles by member of Project Zero. The articles range from philosophical analyses to reports of laboratory studies, deal with several art forms, concern both creation of and response to art, and consider the developing capacity of the child in artistic activities, as well as more mature involvement. The articles, an introduction and four section introductions develop a cognitive-symbolic view of the arts, construing works of art as symbols and artistic activity as involving knowledge, knowing and coming to know in various senses.

5. The how of art: understanding creative process. A course taught in 1974, 1975, 1976, and 1978 Harvard Summer School, D. N. Perkins, instructor.

This course was designed to convey Project Zero and other relevant research on creative process to individuals already professionally involved in arts education, as well as to those looking toward such a career or interested for other reasons. Through readings and discussions, and by involving the students in self-study and self-change projects, the course sought to illustrate how understanding the nature of creative activity leads to implications for the practice of education.

II. Studies of Central Components in the Arts

The second major thrust of this project has entailed an examination of the way in which major symbol-using capacities, particularly those featured in the arts, develop in young children, and how these same components break down under various conditions of brain damage. The purpose of these studies has been to contribute to a model of human symbolic competence, one which will encompass non-artistic as well as artistic skills, and will trace them through the full course of development, from infancy to artistry. Naturally, such an undertaking has not proved possible in its entirety; we have instead examined various artistic skills, and other symbolic competences, with the hope that the processes illuminated might apply to other symbolic skills as well. We have sought, through the dual focus on development and breakdown, to view symbolization from a variety of perspectives; through this multi-pronged attack a comprehensive picture of symbolization may eventually prove possible.

The studies summarized in this section fall into four primary groups. The first, and most extensive section, reviews a range of studies on the development of skills deemed central in the arts. Included here are studies of metaphoric competence, style sensitivity, the emergence of critical skills, and a number of other capacities deemed central to artistry. The second, complementary section, reports selected studies of the breakdown of symbolic competence. Some of these studies focus on the very skills involved in the developmental studies; others touch upon other symbolic competences, or review one aspect of artistry in considerable detail.

The third section reviews studies concerned with more general aspects of symbolic development. This section differs from the initial section in its concentration on the earliest steps of symbolization, its focus on the full range of symbol systems (rather than just those in the arts) and in its concern with the nature of particular symbolic media, such as television. Finally, the last section presents conclusions from a number of more general inquiries on the nature of aesthetic development and aesthetic education. These essays, a distillation of our research findings, have been directed particularly at the educational community.

A. The Development of Central Skills in the Arts

1. Studies of metaphoric competence

Overview: A paradox surrounds the metaphoric competence of young children. On the one hand, young children seem to produce considerable metaphoric language and thus appear "competent" at an early age. Yet, it has often been claimed in the literature that the ability to appreciate metaphor is a late-emerging capacity, one dependent upon considerable capacity for abstraction and "operational thought."

To secure information on this issue, a number of studies of the develop-

ment of competence in understanding and producing metaphors have been conducted. In addition, two papers reviewing our principal findings on metaphoric competence have also been prepared.

* Study 1. Children's metaphoric productions and preferences. Howard Gardner, Ellen Winner, Mary Kircher, and David Perkins, Journal of Child Language, 1975, 2, 125-141.

The capacity to perceive similarity between apparently dissimilar domains is widely regarded as crucial to creative thought; yet little is known about the development of this "metaphoric" skill. To assess children's capacities to effect appropriate "metaphoric links," and to discriminate among metaphors of varying appropriateness, a task probing verbal metaphoric skill was designed. Subjects ranging in age from 4 to 19 years were required to complete a simile and then to choose from a set of four similes the one most appropriate for a given literary context. The study documented a tendency, increasing with age, towards preference for an appropriate metaphor. Whereas primary school children preferred non-metaphoric endings and pre-adolescents favoured conventional metaphors, high school and college students showed significant appreciation of appropriate metaphors. In contrast, conventional metaphors predominated in the subjects' productions and appropriate metaphors were rarely produced by subjects of any age group. Unexpectedly, the highest percentages of appropriate metaphors were produced by the youngest subjects and the oldest subjects. Where these two groups differed was in the proclivity of young subjects to produce metaphors which were highly original but inappropriate or nonsensical. The various strategies used by subjects of different ages are described and the relations between metaphoric productions and preferences are considered.

* Study 2. The development of metaphoric understanding. Ellen Winner, Anne K. Rosenstiel, and Howard Gardner, Developmental Psychology, 1976, 12(4), 289-297.

Two tasks were used to assess children's capacities to interpret metaphoric statements. Subjects ranging in age from 6 to 14 years were required either to explain a metaphoric sentence or to select one of four possible paraphrases. There was a developmental trend toward appropriate apprehension of metaphor. Several steps preceding mature comprehension were described: metonymic and primitive-metaphoric interpretations were frequent prior to the age of 10, and the youngest children sometimes interpreted metaphors as descriptions of magical situations. In general, cross-sensory metaphors proved easier to comprehend than psychological-physical metaphors. The results suggest certain cognitive prerequisites of mature metaphoric comprehension and help to clarify the ontogenetic relations among the abilities to produce, comprehend, and explicate the rationale of metaphoric language.

* Study 3. Matching metaphors with pictures. Ellen Winner

Children's comprehension of metaphors embedded in complete sentences was assessed by asking children to point to one of four pictures. Eighteen metaphoric sentences were used. Nine of these contained psychological-physical metaphors (A heavy heart can really make a difference); 9 contained cross-sensory metaphors (That was a really loud tie). Four pictures were prepared for each sentence: 1) Metaphoric (for the heavy heart metaphor, a person crying); 2) Literal (a person carrying a large heart shaped object, and struggling under the weight; 3) Noun (a plain heart); 4) Adjective (an object that is by definition heavy--a 500 lb. weight). (The pictures were colored; they were laid out simultaneously and at the same time as the subject heard the sentence; and they were randomly ordered.)

After selecting the picture that went best with each orally presented sentence, children were allowed to make a second choice for each item on which they had not chosen the metaphoric picture. Between the 1st and 2nd pictorial choice, for a subset of items, subjects were asked to verbally explicate the metaphoric sentence. For this task, the pictures were removed from sight.

Three groups of subjects participated: 15 preschoolers (mean age = 6.0, rounded to nearest month); 16 second graders (mean age = 8.0); 15 fourth graders (mean age = 9.10).

Results:

First choices: preschoolers preferred literal, 2nd graders preferred metaphoric; 4th graders performed like 2nd graders.

Second choices: When first and second choices are combined, the same pattern emerges. When asked to make a second choice, preschoolers most often chose the adjective picture; thus, it was not the case that the metaphoric picture was preferred even when first and second choices were summed. Thus, the main finding on the picture task is a dramatic rise in metaphoric comprehension between 6-8 years, and a levelling off between 8-10.

Verbal explications:

preschoolers: only offered 36% metaphoric explications
2nd graders: 61%
4th graders: 59%

The main difference in explications emerged between 2nd and 4th grades: there were fewer literal explications for 4th graders (from 12% to 6%), and more inappropriate metaphoric explications for 4th graders (from 7% to 11%).

Summary:

Metaphor comprehension rises sharply between the ages of 6 and 8. A pictorial response mode clearly taps metaphoric comprehension at an earlier age than does a verbal response mode. These results suggest children understand

linguistic metaphors before they can demonstrate this comprehension linguistically. More support is lent to this position by an examination of the reasons supplied by the children in justification of the picture chosen. Often, children chose a metaphoric, then gave a non-metaphoric reason (e.g., just repeated part of the sentence).

* Study 4. Pictorial metaphors. Ellen Winner

A study was devised in order to determine whether children can effect metaphoric matches between two non-verbal (pictorial) elements, and to determine whether there is any relation between children's performance on a metaphor task and a standardized verbal test such as the Stanford Reading Test. One hundred and thirty-six children participated in this study, equally divided between first, third, and fifth grades. A task was devised consisting of 3 conditions. Each form of the test consisted of 12 analogous items.

In the Pictorial Condition, each item consisted of 3 sets of 5" by 11" colored pictures. Each set itself contained three serially connected pictures portraying an event or situation. For example, in one item, the first set of pictures displayed a boy sitting down at his desk at school, taking out a pencil, and beginning to write. The second set displayed a boy coming in from the snow, sitting down, and eating a bowl of hot soup. The third set portrayed a girl crying, who is then hugged and comforted by her mother. Each child was asked to put together the two sets of pictures which were "most alike" and to explain his/her choice. Each item was structured to allow a metaphoric grouping which highlighted a similarity between a physical and a psychological experience. The metaphoric grouping in the example cited above was the boy eating soup and the girl being hugged (physical and psychological warmth). Other kinds of groupings were equally possible. The items were designed, however, so that no other particular kind of similarity was salient.

In the Concrete Verbal Condition, subjects were asked to put together two of three verbal phrases. Each phrase was a description of a corresponding set of pictures in the Pictorial Condition. Each phrase described concretely the activities portrayed in the corresponding pictures.

In the Abstract Verbal Condition, children heard three words and were asked to group the two that were most alike. Each word was an abstraction from the corresponding items in the other conditions (e.g., for the above item, the words used were: study, heat, and love). Subjects were allowed to make two choices for each item.

The following results were obtained.

Pictorial Condition: Almost no metaphoric groupings were made by first graders. Third graders made more metaphoric matches than first graders; however, their most common kind of grouping was a non-metaphoric one (e.g., grouping 2 sets of pictures because they both depicted boys). Fifth graders made more than twice as many metaphoric groupings as third graders; among this age group, metaphoric groupings were the second most common response.

Concrete Verbal Condition: No metaphoric groupings were made by first graders, third graders made a few, and fifth graders effected twice as many metaphoric groupings as third graders. Again, however, metaphoric groupings were never the predominant kind at any age.

Abstract Verbal Condition: First graders made almost none, third graders made a few, and metaphoric matches doubled between third and fifth grades.

Comparison of conditions: No differences were found between conditions among first and third graders (probably due to a floor effect). However, for fifth graders, the Pictorial Condition yielded more metaphoric matches, followed by the Concrete Verbal Condition, and then by the Abstract Verbal Condition. No correlation was found between individual children's performance on this test and his/her score on the Stanford Reading Test.

The findings suggest that it is easier to perceive metaphoric matches visually than linguistically. Quite possibly metaphoric relations are first perceived nonverbally and are only subsequently translated into words.

* Study 5. What does it take to understand a metaphor? A study of sensitivity to "core" meanings. Ellen Winner and Howard Gardner. Paper delivered at a symposium on metaphor and analogy, Society for Research in Child Development, New Orleans, April 1977.

We know that children do not interpret verbal metaphors in the same way as do adults. Indeed, they pass through a series of stages of metaphoric comprehension before they are able to offer an appropriate paraphrase for a linguistic metaphor. These findings raise a puzzling problem: what is it that prohibits children under 10 from understanding a simple metaphoric sentence? What kind of sensitivity to the denotations and connotations of words is necessary in order to "get it right?"

It was hypothesized that, in order to understand a metaphorical use of a particular word, the child must first acquire the "core meaning" of that word. As an example of a core meaning, consider the word coat. The core meaning of coat is "something that covers." Proof that this is the core meaning is gathered by considering the various uses of coat, all of which seem to be bound together by this one unifying core meaning (e.g., a coat of paint, a coat of sadness, a throat coated with medicine; snow coats the trees). We hypothesized that in order to understand a metaphoric use of a word (e.g., coat), the child must know its core meaning and be able to reason by extension from that central meaning to the specific meaning in a particular context.

Six, 8, and 11 year old children were tested for their knowledge of the core meanings of a set of words, as well as for their comprehension of metaphors based on these core meanings. All subjects first received a multiple choice test to tap a passive knowledge of core meanings. The word was read aloud, subjects were asked to select the best meaning from 4 orally presented choices. Children then had to paraphrase sentences each of which

used a word from the multiple choice test in a literal, in a frozen metaphoric sense and in a novel metaphoric sense. (For example, for coat, the literal sentence was: He put on his winter coat. The frozen one was: They put a coat on paint on the house. The novel one was: Each little pebble we found had a green coat on it.) Finally, children were also asked to articulate the core meaning that underlay the different uses of the same word.

We predicted that either demonstration of the ability to articulate the underlying core meaning, or success on the multiple choice task were necessary (although perhaps not sufficient) conditions for correctly paraphrasing the novel metaphoric sentences.

Results: Literal sentences were understood before frozen, frozen before novel. However, contrary to expectation, ability to articulate a core meaning was the last skill to develop. Six and 8 year olds were incapable of articulating the core, and thought the same word had 2 entirely different meanings. Only 11 year olds could verbalize core meanings, and even they could do so only inconsistently. Such a task seems to call upon a sophisticated metalinguistic skill.

On the multiple choice, by 11, subjects consistently chose the core. But, success on novel metaphoric sentences did not predict success on the multiple choice task. For each item, some succeeded on both tasks, some at neither, and some on just one. If a child only got one, it was more often the case that the metaphor was successfully paraphrased, while the multiple choice task was failed.

Thus, comprehension of a metaphor does not seem to require knowledge of a core meaning. Perhaps the core meaning is abstracted only after the child has become familiar with a large variety of uses of a particular word. Perhaps children understand a metaphor by reasoning by analogy from the literal meaning of a particular word.

* Study 6. New names for old things. Ellen Winner. Paper presented at the Stanford Child Language Research Forum, April 1978.

A study was conducted to determine when children begin to use language metaphorically, and the nature of their first metaphors. First, a set of operational criteria was devised in order to distinguish between metaphoric, anomalous, and overextended, word use in early language. These criteria were then applied to all unconventionally used words in the spontaneous speech transcripts of one child (Adam) between 27 and 58.5 months. The majority of Adam's unconventionally used words satisfied the criteria for metaphor. These metaphoric utterances were then further analyzed in order to determine: 1) the role of action in the construction of metaphoric names; 2) the grounds of the metaphors produced; 3) the types of objects that elicited metaphoric names; 4) and the form in which the metaphors were encoded.

When the data were broken down by age, into the months spanning year 2, 3, and 4, the following results were revealed. 1) Almost all of the metaphors at all ages constituted renamings of physical objects. 2) At year 2, the predominant form of metaphor was one in which an object was symbolically transformed by means of pretend gesture and the object was renamed accordingly. In contrast, the most common form of metaphor at year 4 was one effected through the recognition of perceptual similarity, without the support of gesture. 3) The most common metaphoric ground was overall shape. Although with age, several other perceptual grounds were permitted to form the ground of a metaphor, at no age were metaphors frequently based on multiple grounds. 4) Contrary to expectation, metaphors were most often renamings of objects with conventionally specified functions that had to be overridden (e.g., cups, wastebaskets) rather than "abstract" objects with less specified functions (e.g., blocks, shapes cut out of paper). And finally, renamings were most often encoded in the form of metaphors rather than similes; similes, however, increased with age.

These results suggest that the earliest forms of linguistic metaphor can be located in very early child language; that the nonlinguistic roots of metaphor may be found in symbolic play; that the grounds on which early metaphors are based are no different from those on which words are over-extended; that young children can rename objects with highly specific functions that must be countered in the renaming; and that unmarked metaphors emerge prior to marked forms (similes). The relationship between early and mature forms of metaphor are discussed.

* Review Paper 1. The development of figurative language. Howard Gardner, Ellen Winner, Robin Bechhofer, and Dennie Wolf. In K. Nelson (Ed.), Children's language. New York: Gardner Press, 1978.

This paper reviews a variety of studies of figurative language, including studies of metaphor, proverbs, and jokes. Also featured is a model in which the developmental relations between productive and comprehension capacities are explored.

* Review Paper 2. The development of metaphoric competence. Howard Gardner and Ellen Winner, Critical Inquiry, in press.

Addressed to a philosophical audience, this essay explores the relationship between philosophical inquiries into metaphor, and psychological studies of metaphoric competence. The complementary nature of these two lines of inquiry is stressed. Two unresolved questions are discussed: What prevents a school child from understanding a psychological-physical metaphor? What is the relationship between early figures of speech and the metaphors produced by gifted adult writers?

2. Studies of story competence

Overview: While the central place of the story in the life of the child has long been recognized, it is only recently that developmental psychologists have begun to study children's narrational competences. Fresh impetus from this line of research comes from at least two sources: Bruno Bettelheim's stirring discussion of fairy tales in the Uses of Enchantment; and the devising of "story grammars" which can be used for the systematic study of children's ability to produce, understand, and recall stories.

Our own work has reflected these trends. On the one hand, we have ourselves undertaken some studies of children's storytelling competence. Findings from the first three studies are presented in the first papers listed below. In addition, we have taken a serious look at the major influences in the domain of storytelling, and subjected each to a critique.

* Study 1. Once upon a time: The development of sensitivity to story structure. Shelley Rubin and Howard Gardner. Paper presented at Conference on Researching Responses to Literature and the Teaching of Literature, Buffalo, October 1977.

This paper traces the evolution of story competence in young children, with regard to their developing ability to produce and to understand stories of increasing complexity.

In the first half of the paper, the story competence of pre-school-aged children is explored. The authors investigate the emergence of a narrative voice, an early grasp of characterization, and an emerging ability to maintain, extend, and solve problems within a story frame.

The second half of the paper focuses on the narrative competence of school-aged children, with particular emphasis on their developing capacities to draw upon motivational aspects of a story.

* Study 2. A story a story: The influence of the medium on children's apprehension of stories. Laurene Meringoff. Doctoral dissertation, Harvard University, 1978.

While stories have been used throughout history to entertain and transmit information, the specific means for their communication have shifted and proliferated over the years.

This study compares children's apprehension of a story either read to them from an illustrated book or presented as a televised animated film. Two general questions are addressed: 1) Do differences in the structural properties of these media affect how their content is remembered and understood by children? For example, it is hypothesized that film's ability to dynamically depict story actions and, concomitantly, to visually reinforce the corresponding text, will tend to emphasize these events and the enactive features of story characters. In contrast, the discrete static illustrations

in books, providing less visual information, may permit greater attention to primarily auditory content, e.g., figurative language. 2) What difference does age make? Increasing apprehension of stories is expected with age, although the appearance of such differences may vary with the specific task demands. The more interesting question is whether any interactions will be evident between age and medium.

It was important that enough similarity exist in the story's content as presented in each medium and yet that some characteristic use be made of each. The African folktale selected (A Story A Story) existed in both media and was unfamiliar to children. In book form the story appeared over 32 pages illustrated with 17 woodcuts. The video format consisted of an animated film adopting the same graphic style as the book illustrations and with a sound-track prepared using the experimenter's voice as narrator. Pilot interviews were conducted to assess the appeal of the story materials and to pretest response measures.

A total sample of 48 public school children participated in the study, 24 each at ages 6.6-8.0 years and 9.0-10.6 years. Equal numbers of boys and girls at each age were randomly assigned to one of the media and presented the story once. All children were individually tested by the experimenter.

Multiple response measures were used. For example, several measures tapped learning of the story content as presented, including children's verbal recall of the story and their recognition of peripheral visual and auditory content. To discern learning which might go beyond the explicit story content, children were asked to make a number of story-related inferences (e.g., about various attributes of characters and events) and then to account for them. Gesturing behavior accompanying retelling of the story and conversation initiated during the story presentation were also monitored. Scores derived for children's verbal recall of story content (actions, dialogue and figurative language) were each subjected to a two-way analysis of variance. Chi-square analyses were used for the remaining data.

Although preliminary, the findings offer evidence of significant differences in children's responses to comparable story material as presented in these alternative formats. For example, children exposed to the televised story reported: i- significantly higher verbal recall of story actions; ii- more accurate recognition of peripheral visual information among older children; and iii- significantly greater reliance upon visualized content (e.g., character's appearance) as the bases for story-related inferences. More illustrative gesturing also accompanied their story recounting. The picture-book delivery revealed a different set of consequences, including: i- significantly higher verbal recall of figurative language; ii- more accurate recognition of incidental auditory content; and iii- significantly greater use made of textual content (e.g., dialogue) and outside-story knowledge as sources of information for making inferences. Significantly more conversation was initiated during the story delivery. The extent to which age differences appeared depended upon the demands of given

response measures. However, there was little indication of interactions between age and medium.

If media differ consistently in the content they convey more effectively, then, conceivably, children repeatedly exposed to a given medium (like television) may be accumulating experience with some kinds of information more than others and cultivating the particular skills required to extract this information from the modality(ies) in which it is represented. The findings of this research have potential application for cognitive developmental theory, for producers of media materials and for educators using these materials with children.

* Study 3. A brief on behalf of fairy tales. Howard Gardner, A review of B. Bettelheim, The uses of enchantment: The meaning and importance of fairy tales, in Semiotica, 1977, 21, 363-380.

Bettelheim's work is a brilliant tour de force, in which he effectively establishes the importance of fairy tales in the life of the young child. However, some of his claims about children's understandings of such tales are at best unsupported, and quite possibly unwarranted. While it is proper to speculate about how children might understand fairy tales, these speculations are of limited value unless they can be at least potentially supported by some form of empirical data.

* Study 4. From Melvin to Melville: On the relevance to aesthetics of recent research on story comprehension. Howard Gardner, in S. Madeja (Ed.), The arts, cognition, and basic skills. St. Louis: CEMREL, 1978.

Nancy Stein and other researchers have made it possible to study stories systematically through the use of a story grammar. This tool allows one to undertake studies in which the variables constituting narrative are controlled. However, the grammars fail to incorporate aspects of stories which are of literary importance: treated in this essay are the "grammarians'" disregard of affective, aesthetic, and attitudinal aspects of children's literary development.

* Study 5. Children's literary development. Howard Gardner, in T. Chapman and P. McGhee (Eds.), Children's humor. London: John Wiley, in press.

In this major review chapter, studies of children's metaphoric capacities and children's narrative capacities are discussed. Parallels and differences in children's literary competence in these two domains are discussed. A tentative model of literary development is also offered.

3. Studies of style sensitivity

Overview: Even as metaphoric sensitivity is a central skill in artistic activity, the capacity to discern and appreciate style across a variety of media also proves crucial. We have defined style as those recurrent features in an artist's work which allow recognition across diverse products. Proceeding from this definition we have explored the steps of style sensitivity in both literary and visual arts.

* Study 1. Children's sensitivity to literary styles. Howard Gardner and William Lohman, Merrill-Palmer Quarterly, 1975, 21, 113-126.

To determine whether trends observed with other artistic media also apply to licerature, a test of literary style sensitivity was administered to groups averaging 7, 11, 14, and 19 years in age. Subjects were required to select which of two passages came from the same literary work as a model. The passages were presented under different conditions so that the factors affecting style sensitivity might be identified. A general increase in style sensitivity was found across ages, with adolescents demonstrating a more explicit awareness of stylistic features and of the concept of style. Pre-adolescents displayed a strong tendency to focus on subject matter, names, and other dominant figures; there was an interaction of age with condition of presentation, reflecting the painstaking attention directed by eleven-year-olds to details of content. The relatively late emergence of style sensitivity in the literary realm may indicate that the task is a formal operational one, in which a second-order operation must be performed on linguistic messages.

* Study 2. On training sensitivity to painting styles. Jen Silverman, Ellen Winner, Anne K. Rosenstiel, and Howard Gardner, Perception, 1975, 4, 373-384.

A training study was conducted with ten-year-old children (1) to determine the steps through which children pass in learning to sort paintings by style; (2) to investigate the relationship between this and other perceptual and performing skills. Subjects who initially focused on subject matter cues learned to sort paintings by style; a substantial proportion of the subjects succeeded in consistently applying a multidimensional analysis by means of which various compositional components were first independently assessed and their cumulative effects then evaluated. Moreover, the subjects passed through a consistent set of stages en route to style sensitivity. Post-testing revealed that sensitivity to style is more likely to be enhanced if subjects have had intensive exposure to a small set of highly distinctive styles than if they have gained a superficial familiarity with a wide variety of styles; that the classification skills leading to style sensitivity are related to certain discriminative capacities utilized in the sciences; and that subjects trained to attend to certain features of painting show a modest change in their own style of representational drawing. The findings are discussed in terms of the cognitive capacities emerging during the middle years of childhood.

4. Studies of children's drawings

* Study 1. First drawings: Notes on the relation between perception and production in the visual arts. Howard Gardner and Dennie Wolf, in D. Fisher and C. Nodine (Eds.), What is a picture? In preparation.

As part of our longitudinal study of symbolic development, we have examined the early evolution of drawing. In this essay we describe the initial steps involved in a child's drawing. At each stage we explore the relationship between the child's perceptual capacities and his drawing; in the process we establish a closer link between these activities than had hitherto been recognized.

* Study 2. The emergence of aesthetic production and perception in children. J. Thomas Carothers, unpublished undergraduate honor's thesis, Harvard College, June 1978.

This study examined the development of children's drawing skills and the development of children's perception and understanding of artistic works. The research centered around two questions: "Is children's art art?" and "Do children perceive art as art?" Certain aspects of drawings are thought to be essential components for a work to be aesthetic or artistic. This study focused on two such aspects: expressiveness and highly varied line use (utilization of many features of lines: breadth, darkness, shape shading, contrast, etc.). Children's ability to produce and to perceive these aesthetic characteristics in drawings was tested. By testing children across different age levels a general picture of the development of children's ability to create and understand art was obtained.

First, fourth and sixth grade children were tested. It was found that first grade children had little capacity to produce or perceive aesthetic characteristics in drawings. By fourth grade, children had developed the capacities to perceive significant aesthetic properties of drawings. By sixth grade children possessed considerable capacities to produce aesthetic qualities in their drawings. In short, from first to sixth grade children undergo a marked transition from non-aesthetic to aesthetic production and perception in the drawing medium. These results are consonant with the general patterns of development involving transitions from children's conception of the world as a "thing" world to a "property" world and the growth of children's control over symbolic realms.

5. Studies of reality and fantasy

Overview: To appreciate an aesthetic performance, it is crucial that a subject be able to differentiate an actual occurrence with long-term consequences from one which has only been created (or re-created) for the purposes of aesthetic effect. We have undertaken two studies of children's emerging capacity to make discriminations between fantasy and reality.

* Study 1. Dragons and dinosaurs: The child's capacity to differentiate fantasy from reality. Patricia Morison and Howard Gardner, Child Development, 1978, 49.

Despite the indisputable importance of fantasy in children's lives, little is known about their ability to distinguish between fantasy and reality. The present study was conducted to gain information on the extent to which this means of classifying experience is available to and used by children; in addition the contributions of the power exhibited by a character, the source from which the characters is drawn, and the competing modes of classification were assessed. A three-card sorting task was administered to twenty subjects at each of four grades (K, 2, 4, 6). For each set, subjects were given two opportunities to make pairings and to offer explanations for their pairings. In addition, subjects were asked to place twenty pictures into piles of "real" and "pretend" figures. The results document a regular improvement with age in the use of fantasy classifications and explanations. Furthermore, fantasy groupings were more likely to occur when the competing mode of response was categorical and when the characters to be sorted were potent and were drawn from the same source. Fantasy explanations proved infrequent at the younger grades; moreover children at all ages were less prone to offer fantasy explanations than to make fantasy pairings and to sort on that basis when explicitly instructed to do so.

* Study 2. Exploring the realities of television: A developmental study. Patricia Morison, Margaret McCarthy, and Howard Gardner, submitted for publication.

Competent viewers of television have access to a complex set of criteria by which to evaluate the reality or non-reality of various television presentations; yet little is known about the steps through which children must pass in order to acquire these criteria. As an initial attempt to explore the development of this ability a study was designed to examine the ways children reason about and understand television. The study had two central purposes: (1) to gain information on the criteria used by children at varying levels of sophistication in making reality-fantasy judgments and (2) to examine the possible impact of factors such as familiarity with television and knowledge of the workings of the television medium on a subject's sophistication with reality-fantasy. Open-ended interviews were conducted with twelve children in each of the 1st, 3rd and 6th grades. Three different rating scales were developed which assessed each subject's (1) sophistication in reality-fantasy understanding, (2) understanding of the way in which the television medium works and (3) familiarity with television.

Subjects were found to vary widely in their sophistication with reality-fantasy understanding; some descriptive differences between the criteria used by low and high scorers were noted. A series of rank-order correlations were performed for each grade; the correlation between reality-fantasy sophistication and understanding of television concepts were positive and significant for the 1st and 3rd grades, suggesting that children who are more cognizant of reality-fantasy issues also understand more about the structure and operation of television. In contrast, correlations between reality-fantasy sophistication and familiarity with television were

very close to zero for all grades; this finding indicates that the ability to assess the reality status of various types of television is relatively independent of the amount of television watched.

6. Children's conceptions of the arts

* Study 1. Children's conceptions of the arts. Howard Gardner, Ellen Winner, Mary Kircher, and David Perkins, Journal of Child Language, 1975, 2, 125-141.

To complement our study of children's understanding of central aspects of the arts, we have also sought information on children's overall conceptions of the realm of the arts. Through informal clinical interviews with over 100 children of different ages, we have discerned a number of stages of artistic understanding. Young school children exhibit a mechanistic and moralistic approach to the arts: in their view works were made by machines and cannot be tampered with because such an action would be illegal. Children in the middle years of schooling take a very literal approach: drawings must be realistic, poems must rhyme, aesthetic adventuring is out of order. Adolescents take an extremely relativistic stance, suggesting that all works of art are of equal quality, or that preference is simply a matter of taste.

A non-technical version of this article appeared in Psychology Today (Howard Gardner and Ellen Winner, How children learn: Three stages of understanding art. Psychology Today, March, 1976, p. 42. Translated into French, Italian, and Spanish.)

7. Studies of critical judgments by children

* Study 1. The effect of critical comparisons upon children's drawings. Anne Rosenstiel and Howard Gardner, Studies in Art Education, 1977, 19, 36-44.

As children get older, they become more critical about their works and about the works of others. Some commentators have considered this increasing critical acumen to be the cause of the decline in the quality and quantity of drawing found at the time of adolescence. In an effort to assess this hypothesis, children were asked to make drawings and were at the same time exposed to drawings which were either of a higher, or a lower quality than those which they themselves ordinarily produced. Contrary to the hypothesis, children exposed to the better drawings actually worked harder at improving their drawings. At the same time, however, the older children generally offered much lower evaluation of their drawings, suggesting that their increasing critical capacity was indeed influencing their attitude toward the graphic arts.

* Study 2. Discriminating among dimensions of critical judgment: A developmental study. Anne Rosenstiel, Patricia Morison, Jen Silverman, and Howard Gardner, Journal of Aesthetic Education, in press.

Pre-adolescent children exhibit little ability to distinguish from one another a number of criteria by which works of art are judged. Specifically, they tend to equate their personal preferences with technical standards of competence, and with the overall judgment which might be reached by members of their community. Even among adolescents, these dimensions of judgment are often confused with one another, and little sophistication in aesthetic judgment is encountered.

B. The Breakdown of Symbolic Competence

Overview: It is desirable to investigate symbolic-using capacities in the intact normal adult. Often, however, these processes are operating with such skill and fluency that it becomes difficult to unravel component parts: the difficulty becomes quite acute in the case of artistry, where artistic skills often prove difficult, if not impervious, to analysis in in vivo form.

For this reason, the opportunities provided by neuropsychological investigations assume great importance. In the brain damaged person, skills break down (or are spared) in ways which help to illuminate their structure in the normal individual. We have had the opportunity to investigate a variety of symbolic skills in brain damaged patients. Included have been skills of special importance in the arts (sensitivity to metaphor, sensitivity to humor, capacity to draw, sensitivity to musical meaning); skills of importance for effective communication (the ability to answer a question directly, rather than to confabulate); and the capacity to "read" various kinds of symbols. The results of some of these inquiries were summarized in Gardner's book The Shattered Mind (1975). Most of the research reported here was supported in part by the National Institute of Neurological Diseases, Communication Disorders and Stroke.

* Study 1. Comprehension of metaphor in brain-damaged patients. Ellen Winner and Howard Gardner, Brain, 1977, 100, 719-727.

While the dominance of the left hemisphere for linguistic processing has been well established, this characterization relies upon findings obtained with literal uses of language. Whether the left hemisphere is equally dominant for the comprehension of figurative language is not known. Attempts to characterize the dominance of the right hemisphere have been of various sorts, including the suggestion that it assumes a crucial role in aesthetic sensitivity. Based largely on results obtained with pictorial stimuli, however, this claim is confounded with putative right hemisphere dominance for visuo-spatial processing.

Metaphoric language, in which two usually remote terms are joined in a

single figure of speech, offers an opportunity to assess both the "linguistic" and the "aesthetic" characterizations. To permit such an assessment, two tests of metaphoric competence were administered to four groups of brain-damaged patients and to normal controls. An unexpected double-dissociation was obtained between patients with unilateral lesions. Patients with injuries of the left hemisphere (all aphasic) proved competent in matching a metaphoric figure with its appropriate pictorial interpretation; however, these patients typically offered "concrete" or "literal" verbal explications of the linguistic tropes. Right-hemisphere-injured patients were able to offer verbal explications of the metaphors; however, unlike both normal and left hemisphere groups, they chose literal as often as metaphorically appropriate interpretations of the metaphors. Moreover, the patients with lesions of the right hemisphere rarely found the literal depictions amusing and sometimes resisted the explication task. A small group of demented patients presented a response pattern on the pictorial (but not the verbal) task similar to that exhibited by the patients with right-sided lesions.

The results challenge both the "linguistic" and the "aesthetic" characterizations of cerebral lateralization. An alternative account is proposed, in which both hemispheres contribute in characteristic ways to metaphoric competence and, more generally, to linguistic and aesthetic sensitivity.

* Study 2. Comprehension and appreciation of humorous material following brain damage. Howard Gardner, Paul K. Ling, Laurie Flamm, and Jen Silverman, Brain, 1975, 98, 399-412.

The effects of brain damage on cognitive and affective status have been assessed separately; however, a dearth of information exists about the interaction of these facets in the brain-damaged patient. Because appreciation of humour involves both cognitive and affective dimensions, an investigation of response to humorous materials should yield information relevant to this issue. In addition, a study of response to humour in aphasic patients can reveal the extent to which appreciation of humour is dependent upon an intact language system. Accordingly a test of humour, in which an individual chose the "funniest" of four cartoons, was administered to a population of brain-damaged and control patients.

Ability to detect the most humorous cartoon was impaired in all brain-damaged patients, more in severe than in mild aphasics, but there was no significant difference between patients with left and right hemisphere lesions in their overall performance on the test. A different order of difficulty across items, and a different profile of "mirth" responses to the items did, however, correlate with site of lesion. Right hemisphere patients tended either to laugh throughout or, more frequently, not al all; they often confabulated answers or made impossible inferences; and they performed better on items with captions. Their cognitive reactions appeared "dissociated" from their affective responses. In contrast left hemisphere patients performed better on the captionless items and behaved in a manner

which more closely approximated normal subjects in their humorous reactions, their order of item difficulty, and their explanations. All brain-damaged patients found it relatively easier to locate the humorous cartoons when the members of a set differed appreciably from one another. These results provide information about the altered cognitive and affective states of brain-damaged patients, the impairment of cognitive operations in aphasic patients, and the respective "life-spaces" of left and right hemisphere injured patients.

* Study 3. Visual agnosia in an artist. Wendy Wapner, Ted Judd, and Howard Gardner, Cortex, in press.

This report describes a 73 year old left-handed male artist who presented with agnosic symptoms following an occipital cerebral vascular accident. Against a background of a memory disturbance, but otherwise essentially intact linguistic and cognitive capacities, the patient was generally unable to identify single objects on visual presentation, and displayed marked difficulty in interpreting complex objects, depicted scenes, and partially occluded figures. The patient's preserved ability to recognize geometric forms, to perceive optical illusions, and to copy designs and objects with considerable accuracy suggested the clinical picture of visual agnosia.

An examination was undertaken of the effects of this recognition disorder on the artist's capacity to draw. Despite an inability to recognize an object or scene, the patient retained various techniques (perspective, shadowing, designation of texture) which allowed him to copy the display in a veridical fashion. When displays were recognized, or when the patient was given only the name of the object and asked to draw it, he adopted a less slavish approach, characteristic of his pre-morbid artwork. While his post-morbid drawings bore a strong similarity to his earlier works, such features as insufficient differentiation of figure from ground, over-elaboration of details, and areas of neglect revealed the debilitating effects of the recognition disorder. Moreover, an examination of the patient's strategies revealed numerous compensatory verbal and motor procedures which guided his drawing.

* Study 4. Sensitivity to musical denotation and connotation in organic patients. Howard Gardner, Jen Silverman, G. Denes, C. Semenza, and Anne Rosenstiel, Cortex, 1977, 13, 242-256.

Musical segments convey at least two kinds of meaning: The "real-world" events referred to by lyrics and by occasions of performance constitute musical denotation; the formal expressive patterns suggested by such constituents as pitch, timbre, and intensity constitute musical connotation. To ascertain sensitivity to these musical facets among brain-injured patients, tests assessing appreciation of musical denotation and connotation were administered to unilaterally brain-injured subjects in the United States and Italy.

On the musical denotation test, right hemisphere patients excelled

on items where knowledge of lyrics was required; in contrast, anterior aphasics surpassed both posterior aphasics and right hemisphere patients on items where acquaintance with lyrics was unnecessary. On the musical connotation test, right hemisphere patients performed relatively better in matching sound patterns to temporally-sequenced designs than to gestalten; these patients also performed better than left hemisphere patients on a number of other dimensions. The relatively high performance of posterior aphasics on the connotation test, along with the lack of correlation between connotative and denotative scores received by aphasic patients, suggest a behavioral and neurological dissociation between the two forms of musical sensitivity.

* Study 5. A study of confabulation. Brian Mercer, Wendy Wapner, Howard Gardner, and Frank Benson, Archives of Neurology, 1977, 34, 429-433.

Confabulation consequent to organic amnesia is a well-described clinical finding. A number of plausible theories of confabulation have been proposed, but the various claims and counterclaims have not been systematically tested. A standardized test battery that included four different kinds of questions plus measures of suggestibility and the tendency to utilize external cues was administered to ten amnesic patients who demonstrated varying degrees of confabulation. One additional patient, whose clinical condition changed dramatically during his hospital course, received the battery on a number of occasions.

Differences among patients were found in overall performance, degree of confabulation, and ability to use cues. Hypothesized relationships between confabulation and suggestibility, degree of memory disorder, and degree of disorientation were not confirmed. However, confabulation proved to be strongly related to the inability to withhold answers, to monitor one's own responses, and to provide verbal self-corrections. These results suggest a tentative model of the process of confabulation as well as a number of useful clinical signs indicating recovery from amnesia.

* Study 6. Three Studies of Reading in Aphasic Patients

A. Bee but not Be: Oral reading of single words in aphasia and alexia. Howard Gardner and Edgar Zurif, Neuropsychologia, 1975, 13, 181-190.

Three studies are reported of the oral reading ability of language-impaired patients. Part of speech and picturability are shown to contribute to a word's readability. In addition, words whose referents can be easily manipulated (operative nouns) prove easier to read than matched words whose referents are relatively figurative.

Comparisons of reading and naming ability were drawn between aphasic patients and patients clinically diagnosed as alexic. These comparisons

suggest that for most aphasics reading and naming are mediated by separate mechanisms, with the ability to read being relatively spared; that alexics without agraphia achieve most success with short words, irrespective of part of speech; that alexics with agraphia achieve most success with picturable nouns, even when these contain more letters. In alexia with agraphia, reading and naming occur at a comparable level and may be mediated by identical or similar cognitive mechanisms.

B. Critical reading of words and phrases in aphasia. Howard Gardner and Edgar Zurif, Brain and Language, 1976, 3, 173-190.

To assess ability to read critically at the word and phrase level, four tests were administered to aphasic patients blocked on site of lesion and severity of auditory comprehension defect. Overall, site of lesion did not affect the quantitative scores or the patterns of errors in the four tests; this result suggests that there is a fixed order of difficulty in reading comprehension irrespective of the locus of the aphasic deficit. In contrast, profiles of performance differed significantly, depending on severity of comprehension difficulty. Patients with significant comprehension defect proved relatively superior at recognizing misspelled words; relatively poor at matching written nouns with their depicted referents; less likely to display improved comprehension when an additional substantive was included in a written phrase; relatively better at recognizing which words were the same parts of speech than at recognizing which words share salient semantic features; and relatively better at matching words which belonged together than at choosing the word which does not belong to a set. Taken together, the results suggest that strategies of reading may change in the presence of a severe aphasia, with such impaired patients relying less on semantic considerations and consequently more on orthographic information and on the distributional and sequential properties of words in sentences.

C. Critical reading at the sentence level in aphasia. Howard Gardner, G. Denes, and Edgar Zurif, Cortex, 1975, 11, 60-72.

A sentence-reading test was devised in order to assess the aphasic's ability to detect errors in written discourse. One hundred pairs of sentences, each containing one correct and one erroneous sentence, were presented to the patients, who were required to locate the error in one of the two sentences. So that comprehension in the auditory and visual modalities might be compared, the identical test was administered orally to a subset of the aphasic population.

Contrary to expectations, there was no difference in overall scores between patients with anterior and posterior pathology. Anterior patients performed somewhat better on the oral version, posterior patients on the written version of the test. Finally, an examination of errors revealed a regular order of difficulty in sentences which featured contradictions to "real-world" knowledge, irrespective of the locus of brain damage, while the order of difficulty of sentences featuring syntactic deviations differed appreciably, depending on the locus of lesion. An attempt is made

to relate these findings to current experimental and clinical knowledge.

In addition to the book on the person after brain damage, and these specific research studies, two more general pieces on neuropsychology were prepared. "The loss of language" (Howard Gardner in Human Nature, March 1978, 76-84) summarized the effects of a stroke on a person's linguistic capacities. "What we do and don't know about the two halves of the brain" (Howard Gardner in The Harvard Magazine, March-April 1978, 24-27) subjects to scrutiny the current excessive claims about the functions of the two cerebral hemispheres. This latter essay was reprinted in the Journal of Aesthetic Education, 1978, 12, 113-119.

C. General Symbolic Development

Overview: In addition to those studies which have focused specifically on artistic skills, our developmental investigations have sampled a broad range of symbolic capacities. Much of this research has been undertaken in the context of a longitudinal study of early symbolization, supported principally by the Spencer Foundation. In this study a small group of first born youngsters has been followed on a weekly basis for several years, and observations have been made on their initial steps in seven separate symbolic media. The first studies reported below have grown out of this study. At the same time, we have also considered more general aspects of early symbolization as well, and have compared findings on the development of symbolization with results concerning the breakdown of symbolic capacities (see II.B. also).

* Study 1. Artistic symbols in early childhood. Howard Gardner, Dennie Wolf, and Anne Smith, New York University Education Quarterly, 1975, 6, 13-21.

This paper reports an initial study of twelve 2 to 4 year olds, whose performances in four different media were examined. Two contrasting styles of early symbol use were ascertained. In addition, this study made clear that such pre-schoolers have already attained considerable symbolic competence across several media. Thus a longitudinal study using younger subjects was indicated.

* Study 2. Style and sequence in early symbolic play. Dennie Wolf and Howard Gardner, in M. Franklin and N. Smith (Eds.), Early symbolization. Hillsdale, N.J.: Erlbaum, in press.

Using longitudinal case-studies of symbolic development in two children, this paper addresses the question of the stability and impact of individual cognitive styles on a major developmental task: symbolization. The paper focuses on the domain of symbolic play, and charts the manner in which each of the two children makes her way from the sheer manipulation of objects in object play toward the possibility of playing out imaginary events with small toys. The distinctive characteristics of each child's individual approach to this task are outlined. It is suggested that they are symptomatic of

general approaches to symbolic activity. Some children, termed "patterners" tend to focus on the stable physical properties of objects (size, shape, color, number) and enjoy manipulations which play on just such characteristics (e.g., puzzles, visually based metaphors, drawing and building). By contrast, other children focus more on the social meaning of objects (how they are used in daily life, what they may mean to people) and enjoy the construction of events around these shared meanings (imaginative play, storytelling, pantomime). These children have been termed "dramatists."

* Study 3. Exploring early symbolization: Style of achievement. Jennifer Shotwell, Dennie Wolf, and Howard Gardner, in B. Sutton-Smith (Ed.), Symposium on play. In preparation.

This paper presents a discussion of individual differences in the development of early symbolization in two media, symbolic play and three-dimensional construction. Two styles of early symbol mastery are presented: patterners are children who show a strong interest and skill in configurational uses of materials while dramatists exhibit an interest in sequences of interpersonal events having dramatic or narrational structures. The chief source of information has been a longitudinal study of nine first-born middle-class children who have been observed on a regular (weekly or bi-weekly) basis since the age of one.

First, background information about general cognitive and media milestones at three early ages (12 months, 24 months, 30-36 months) is presented. Next, the principal steps entailed in the development of skills in the two relevant media are sketched. Finally, a fuller discussion follows of how the acquisition of such media-specific accomplishments (shared across children) may be effected quite differently by patterners and dramatists. Some speculative discussion is then offered, suggesting how these individual differences may manifest themselves at early school-age.

* Study 4. Otherhood: The development of an independent agent concept. Dennie Wolf, doctoral dissertation, Harvard University, 1978.

This thesis uses an intensive case-study, coupled with research from diverse traditions, to propose an initial description for the manner in which children develop a concept of independent agency. The concept of independent agency is defined as understanding that others can initiate and pursue actions which may be distinct from the child's own. More specifically, the thesis explores how an initially pragmatic grasp on the independence of others is sharpened as it is encoded in the child's earliest symbolic statements about actions and their actors--simple sentences and make-believe sequences. In this way, the development of an independent agent concept illuminates two fundamental aspects of the process of becoming human--socialization and symbolization.

The introduction to the thesis poses the problem of developing a complex but integrated picture of what it is for the infant "to become human." It nominates the development of an agent concept as an aspect of infant growth that will encourage the integration of both cognitive and social achievements.

Chapter I sets out a careful definition for "holding an agent concept" both in pragmatic and symbolic terms. It points out that previous descriptions of this process have been casual in their definitions and so neglected the course and the consequences of the child's having to translate his/her pragmatic understandings of agency into symbolic terms.

Chapter II describes and discusses the manner in which the observations forming the core of the study were collected. It contains the proposal that even intensive longitudinal case-studies can offer systematic information as well as intimate observations.

Chapter III provides an overview of the development of a sense of others as independent agents within the first year. It provides the foundations for Chapter IV which presents a narrative description of the development of an agent concept in the second year. Drawing on observations, parent diaries, and task responses, a complex picture of this process emerges. In its broadest outlines, the data suggest that there are three major periods in the development of a concept of agency. At a year, there is "role fusion," the child failing to distinguish between his own activity and the separate actions of others. Between twelve and eighteen months, through the medium of face-to-face interchange in games and early conversations, the child develops an understanding of the separateness and variety of situational roles. Between eighteen months and two years, the child slowly translates this knowledge into two early symbolic grammars, language and play.

* Study 5. On the acquisition of first symbol systems. Howard Gardner, Studies in the Anthropology of Visual Communication, 1976, 3, 22-37.

Two patterns of symbolic acquisition are outlined here. The first is the series of steps through which young children pass as they acquire the capacity to draw representationally. The second is the series of steps through which aphasic patients pass as they learn to master an alternative, visually-based symbol system. Surprising parallels emerge between the two trajectories of acquisition.

* Study 6. The development and breakdown of symbolic capacities: A search for general principles. Howard Gardner, in A. Caramazza and E. Zurif (Eds.), The acquisition and breakdown of language. Baltimore: Johns Hopkins University Press, 1978.

It has generally been held that patterns of breakdown following brain damage simply mirror the well-established patterns of acquisition. When the same tasks are actually examined from these two perspectives, however, a more complex picture emerges. That is, in some areas (e.g., naming) patterns of development and breakdown mirror one another; in other areas, however (e.g., metaphoric comprehension), the patterns of breakdown deviate in instructive ways from the pattern of acquisition.

D. Aesthetic Development and Aesthetic Education: Selected Essays

While the major thrust of this research program has fallen on the execution of discrete experimental and observational studies, we have been aware throughout of the need (and importance) of offering more general syntheses of our findings. These efforts not only give us an opportunity to ponder the interrelations among our disparate studies; they also offer suggestions and descriptions which may prove of special use to the aesthetic education community.

The essays noted below fall into four categories. To begin with, there are a few descriptions of Project Zero prepared for various interested audiences. Next, we include an initial effort to relate our work to a specific medium of importance in our society--that of television. Several papers attempt a theoretical synthesis of a number of our inquiries. Finally, two essays offer some suggestion about the possible future course for a psychology of art.

1. Project Zero

* Essay 1. Harvard Project Zero - Moving from zero to one. David Perkins and Howard Gardner, Harvard Graduate School of Education Association Bulletin, 1974, 18(2), 5-10.

In this paper some examples of our work are described.

* Essay 2. Promising paths to knowledge. Howard Gardner, Journal of Aesthetic Education, 1976, 10, 201-207.

Composed on the tenth anniversary of Project Zero, and in honor of the tenth anniversary of the Journal of Aesthetic Education, this essay describes some benefits of an approach that considers aspects of development and breakdown in the arts.

2. Television

* Essay 1. Symbolic bridges to the arts. Howard Gardner

This essay discusses the ways in which arts programming might be presented on television. Stressed are the points that the arts use symbolic languages, and that any presentation on television must take into account the fact that many viewers will not know the appropriate languages.

* Essay 2. The child as perceiver, producer, and critic of the arts. Paula Wilder and S. William Ives, in M. Harmonay (Ed.), Promise and performance: ACT's guide to TV programming for children (Vol. II: The arts), in preparation.

The development of children's abilities to participate in the arts as perceivers, producers, and critics is outlined. This framework is then used to discuss the role of television in promoting each of the three capacities. It is concluded that television can best supplement classroom instruction by making use of the qualities which are unique to the medium rather than simply attempting to reproduce classroom experiences.

3. General theoretical essays

* Essay 1. Illuminating comparisons. Howard Gardner, in M. Henle (Ed.), Vision and artifact. New York: Springer, 1976.

Composed in honor of Rudolf Arnheim's 70th brithday, this Festschrift essay discusses the educational benefits which can accrue from making comparisons among superficially similar works of art.

* Essay 2. Unfolding or training: On the optimal approach to art education. Howard Gardner, in E. Eisner (Ed.), Children's artistic development: Its nature and nurture. McCutchan Publishing, 1976.

One approach to art education favors intensive training of skills; a rival school prefers to let artistic talents flower spontaneously. This essay suggests that the preschool years are the optimal time for natural flowering, the school years a time when intelligent intervention can be profitable.

* Essay 3. Beyond playing or polishing: The development of artistry. Dennie Wolf and Howard Gardner, in J. Hausman (Ed.), Arts exemplars models, in press.

This paper examines two recurrent views of artistry--that of the artist as the imaginative dreamer and the other of the artist as the skilled craftsperson. Against the background of these two contrasting views of creativity, the development of artistic and symbolic skills is explored, from infancy to early adulthood. The paper suggests that the nature of artistic endeavor changes significantly across the life-span, veering from self-expression in early childhood towards a rather exacting interest in technique during the school years. By comparison, during adolescence, young artists consider, for the first time, the difficult task of balancing the two equally important aspects of creativity--feeling and form.

* Essay 4. On going beyond the literal: The development of sensitivity to artistic symbols. Jen Silverman, Ellen Winner, and Howard Gardner, Semiotica, 1976, 18, 291-312.

Children in the middle years of school are intensely literal-minded. They reject metaphoric language; they view paintings solely in terms of their subject matter. These prejudices are not irremediable, however. Training studies reveal a regular set of steps in which children can be aided to proceed beyond the literal, helped to see the variety of ways in which words or depictions can be utilized. Such transcending of the literal is an essential component of mature artistry.

4. Future work

* Essay 1. Challenges for a psychology of art. Howard Gardner, Scientific Aesthetics, 1976, 1, 19-33.

Four promising lines of investigation in the psychology of the arts are described: (1) While the skills of a particular master may prove difficult to illuminate, it is possible to investigate those skills which are necessary antecedents to significant accomplishment in the arts. Two hitherto neglected avenues of research help clarify the nature of artistic skills: developmental studies, in which the emergence of various artistic capacities is probed; and neuropsychological investigations, where the breakdown of skills can be examined in individual case studies. (2) The specific media and symbol systems utilized in various art forms require separate study. The functioning of cognitive and perceptual processes may well differ, depending on the particular symbol system employed in a given art form. (3) The potent subjective experiences involved in artistic activity deserve explication. Two research models may prove relevant: structural analyses of works of art, which pinpoint those properties which are present across diverse sources; and ethological investigations of organisms, in which those environmental properties which elicit strong reactions can be specified. (4) Though such research emphasizes the defining characteristics

of artistic experience, investigators should also examine the relationships between artistic and scientific modes of behavior and thought.

* Essay 2. Sifting the special from the shared: Notes toward an agenda for research in arts education. Howard Gardner, in S. Madeja (Ed.), Arts and aesthetics: An agenda for the future. St. Louis: Cemrel, 1977; and in Journal of Aesthetic Education, 1977, 11, 31-44.

Offered at the first Aspen Conference sponsored by CEMREL, this essay suggests an agenda for future work in the area of arts research. It is suggested that researchers must distinguish those capacities which are peculiar to the arts, or which are specially highlighted there, from those other, equally important capacities, which are involved in all cognition, or which cut across the art-science dichotomy. Some limitations of a cognitive view of the arts are also discussed.

COURSES TAUGHT

H. Gardner, "An Introduction to Developmental Psychology," Harvard Summer School, 1975.

H. Gardner and D. Perkins, "The Development of Symbol Use," Harvard Graduate School of Education, Spring 1975.

D. Perkins, "The How of Art: Understanding Creative Process," Harvard Summer School, 1974, 1975, 1976, 1978.

PROJECT ZERO MEETINGS AND VISITORS

1974

Annual meeting of original Project Zero members

1975

Annual meeting of original Project Zero members

1976

Dr. Virginia Demos, Harvard Medical School, gave seminar, "Affective Development in Early Childhood."

Morton Schindel, director of Weston Woods, a company that prepares films of children's books.

Nancy Stein and Lois Orchard, Washington University, presented two-day workshop on story comprehension in children.

Dr. Sidney Strauss, Tel Aviv University, gave seminar on "U-shaped Curves," in development.

1977

Dr. Elizabeth Bates, University of Colorado, presented two papers on symbolization in humans.

Dr. George Forman, University of Massachusetts, presented his work on block play and logic.

Dr. Claire Golomb, University of Massachusetts, talked about "Children's Play."

Dr. Harlan Hoffa, Pennsylvania State University, visited the Project in order to make a report to an HEW panel.

Dr. Robert Hoffman, Westfield State College, Westfield, Ma., discussed his research on metaphor.

Dr. Stephen Kosslyn, Harvard University, discussed research on children's internal representations of objects.

Dr. David Olson, Ontario Institute for Studies in Education, Toronto, discussed research on children's perceptual development.

Dr. Gavriel Salomon, Hebrew University, discussed his work on children's apprehension of television.

Dr. Jean Shub, SUNY, Albany, New York, presented her work on early symbolization in language-delayed children.

Dr. David Sudnoy, Cambridge, Ma., spoke on musical improvisation.

Dr. Robert Verbrugge, University of Conntecticut, presented his research on metaphoric comprehension.

CONFERENCES ATTENDED

1974

H. Gardner, "Television Art and Information," sponsored by the National Center for Experiments in Television

H. Gardner, curriculum planning meetings of the Ford Foundation's Television Arts Project.

1975

H. Gardner, series of meetings on "Affective Development" at Social Science Research Council, New York.

H. Gardner, "Children's Television and the Arts," sponsored by Action for Children's Television, Atlanta, Ga.

H. Gardner, Social Science Research Council Committee on Affective Development, New York.

H. Gardner and D. Wolf, "Symbolization and the Young Child," Wheelock College, Boston.

1976

H. Gardner, Social Science Research Council Committee on Gifted Children, New York.

1977

H. Gardner, symposium on play at Society for Research in Child Development, New Orleans.

H. Gardner, conference on metaphor sponsored by NIE at University of Illinois.

H. Gardner, workshop on "Symbolization and Media," Boston.

H. Gardner and D. Perkins, CEMREL planning conference to design the conference, "The Arts, Cognition, and Basic Skills."

H. Gardner and D. Perkins, "The Arts, Cognition, and Basic Skills, sponsored by CEMREL and NIE, Aspen, Colorado.

CONSULTATION

1973

Metropolitan Museum, New York

Museum of Fine Arts, Boston

1974

Living and Learning Center, Lexington, Ma.

deYoung Art Museum, San Francisco, Ca.

Minneapolis Institute of Art, Minneapolis

Television Arts Project, curriculum planning meetings in San Francisco, Cambridge, and Ann Arbor.

1975

Minneapolis Institute of Art

1976

Toledo Museum of Art, Toledo, Ohio

1977

Philadelphia Museum of Art, Philadelphia

CEMREL, St. Louis, Missouri

PRESENTATIONS

1973

H. Gardner, "Portrait of the Child as an Artist," University of Pennsylvania; also presented at the Harvard Medical School.

1974

H. Gardner, workshop on artistic development, Teacher's College, Columbia University

H. Gardner, "Unfolding or Training: On the Optimal Route to Artistic Accomplishment," Stanford University

H. Gardner, "Structural Psychology," and "New Developments in the Psychology of Art," APA in New Orleans, La.

H. Gardner, presentation of Project Zero's work to National Academy of Education meeting in Cambridge, Ma.

H. Gardner, "First Communications," Annenberg School, University of Pennsylvania.

H. Gardner, "The Artistic Development of the Child," keynote address at symposium, "You, Your Child and Art," New York University

H. Gardner, "Visual Communication Therapy," Academy of Aphasia meetings, Warrenton, Va.

N. Goodman, presentation of Project Zero's work to National Academy of Education meeting in Cambridge, Ma.

D. Perkins, presentation of Project Zero's work to National Academy of Education meeting in Cambridge, Ma.

1975

H. Gardner, "Thoughts on Symbolization in Normal Children and Aphasic Adults," Harvard University.

H. Gardner, "Artistic Development in the Child," Johns Hopkins University.

H. Gardner, "Sparing of Communicative Functions in Aphasia," International Neuropsychology Society.

H. Gardner, paper on metaphoric capacity in children at Society for Research in Child Development meetings in Denver, Colorado.

H. Gardner, "Symbolic Development in Childhood, University of Chicago.

H. Gardner, "Artistic Development of the Child," Massachusetts Psychological Association meetings.

H. Gardner, witness for Rockefeller Panel on Art, Education and the Americans, New York.

H. Gardner, "Visual Communication in Aphasia," at New York Academy of Sciences Conference, "Origins and Evolution of Language."

H. Gardner, "Artistic Capacities in Aphasia," Academy of Aphasia, Vancouver, British Columbia.

H. Gardner, "Symbolic Capacities in Brain-Damaged Patients," New England Psychological Association.

H. Gardner, "Can One Enter the World of the Brain-Damaged Patient?" Boston Society for Phenomenology and the Social Sciences, Boston.

D. Perkins, "Effects of Viewing Pictures form Non-standard Angles," Scarborough College, University of Toronto.

D. Perkins, "Bricks and Blobs," Picture Perception Conference, Center for Research in Human Learning, University of Minnesota.

D. Perkins, "Noticing: An Aspect of Skill," Euclid Conference on Basic Mathematical Skills and Learning, Euclid, Ohio.

D. Perkins, "Theory in Arts and Education: The Pound of Feathers and the Pound of Lead," The Arts in Education Conference, Wingspread Conference Center, Racine, Wisconsin.

E. Winner, "Can Elementary School Children Produce Metaphoric Figures?" Society for Research in Child Development meetings, Denver, Colorado.

1976

H. Gardner, "Responsive Evaluation of Aesthetic Education Program," at a symposium sponsored by JDR III Fund, Florida Educational Research Association meetings.

H. Gardner, "Metaphoric Thought in Children and Brain-Damaged Patients," Boston University and Williams College.

H. Gardner, "Brain Damage and the Mind," Williams College.

H. Gardner, "Artistic Knowledge in Brain-Damaged Patients," Psychiatry Grand Rounds, Albert Einstein College of Medicine.

H. Gardner, "Reading Disturbances after Brain Damage," Boston VA Hospital, and Harvard Graduate School of Education.

H. Gardner, "Symbolic Competence: The Roots of Creativity," address to the Jean Piaget Society, Philadelphia.

H. Gardner, "Artistic Symbols and Museum Education," annual meeting of American Association of Museums, Washington, D.C.

H. Gardner, "Reading of Natural Language and Artificial Language in Aphasia," International Neuropsychology Symposium, Roc-amadour, France.

H. Gardner, "Sifting the Special from the Shared: Notes toward an Agenda for Research in Art Education," CEMREL-NIE conference on art education, Aspen, Colorado.

H. Gardner, "The Psychology of Art," annual meeting of APA, Washington, D.C.

H. Gardner, "The Development of Symbolic Capacities," Ontario Institute for Studies in Education, Toronto.

H. Gardner, "Pragmatic Use of Gesture in Aphasic Communication," Conference on Sign Language and Neurolinguistics, Rochester, N.Y.

H. Gardner (co-author), "Analysis of Repetition in Transcortical Aphasia," Academy of Aphasia, Miami, Fla.

S.W. Ives, "Children's Graphic Representation," Mass. College of Art, Boston.

D. Perkins, "Talk About Art," The Arts and Aesthetics: An Agenda for the Future," conference at Aspen, Colorado.

D. Perkins, "Computer and Human Perception of Picture-like Scenes: A Comparison," Conference on Pictorial Perception, Center for Research in Human Learning, University of Minnesota.

E. Winner, "The Development of Metaphoric Language," Wheaton College.

D. Wolf, "Patterners and Dramatists: Individual Differences in Early Symbolic Development," Harvard Medical School.

D. Wolf and H. Gardner, "Research in Art Education," workshop at Mass. College of Art, Boston.

1977

H. Gardner, "Artistry after Brain Damage," Department of Psychology, Harvard University.

H. Gardner, talk on children's sensitivity to different artistic media, presented to staff of National Geographic World, Washington, D.C.

H. Gardner, colloquium on artistry after brain damage, Upstate Medical Center, Syracuse University.

H. Gardner, talk on symbolic development at Hebrew University; talk on metaphoric understanding at Tel-Aviv University.

H. Gardner, "Exploring Early Symbolization: Styles of Achievement," Wenner-Gren Symposium on Fundamental of Symbolism at Burg-Wartenstein, Austria.

H. Gardner, "Symbolic Capacities after Aphasia," International Neuropsychology Society, Oxford, England.

H. Gardner, three papers at Academy of Aphasia meetings, Montreal.

H. Gardner (with S. Rubin), paper on children's apprehension of stories, at Conference on Researching Responses to Literature and the Teaching of Literature, Buffalo, New York.

H. Gardner, two addresses to Ontario Psychological Association.

H. Gardner and D. Perkins, "Harvard Project Zero: A Progress Report," to the staff of NIE, Washington, D.C.

H. Gardner and E. Winner, "What Does it Take to Understand a Metaphor?" Society for Research in Child Development, New Orleans.

S.W. Ives, "Children's Ability to Coordinate Spatial Perspectives through Linguistic Descriptions," Society for Research in Child Development, New Orleans; and Harvard University.

D. Perkins, "Art and the 'Aha' Experience," and three informal seminars, Department of Art Education, Ohio State University.

D. Perkins, "The Significance of Interpretive Disagreements for Cognitive Theories of the Arts," response to Anita Silvers, Conference on the Arts, Cognition and Basic Skills, Aspen, Colo.

E. Winner, "The Metaphoric Function of Early Language," New England Psychological Association, Clark University.

E. Winner, "The Development of Metaphoric Skills," Wheelock College, Boston.

D. Wolf, "Early Symbolization," Personality and Development Seminar, Harvard University.

D. Wolf, "Styles of Symbolization and Reading," Wheelock College, Boston.